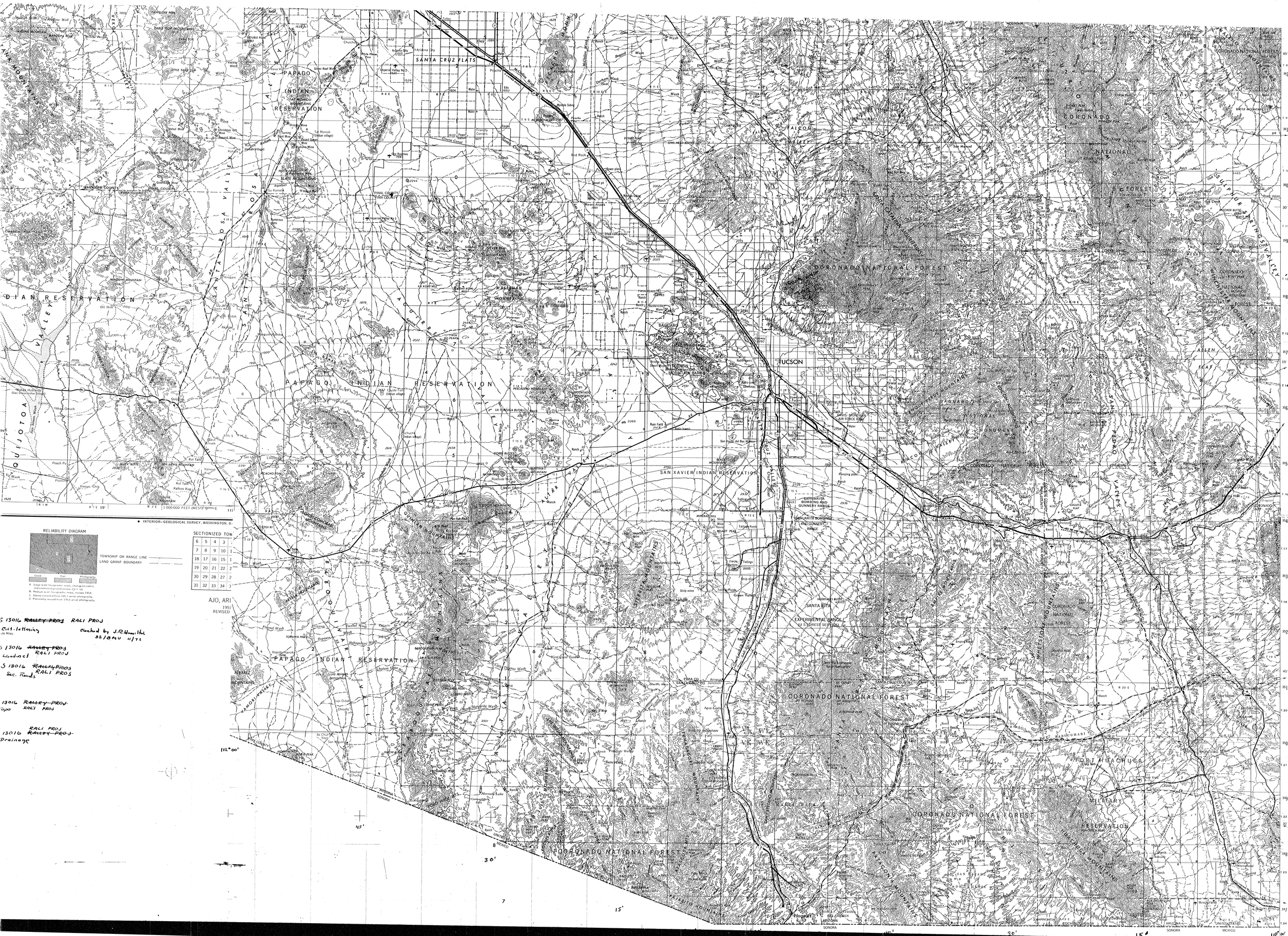


RELIABILITY DIAGRAM

TOWNSHIP OR RANGE LINE
LAND GRANT BOUNDARY

A. Large scale topographic maps, photogrammetric and controlled ground survey, 1927-50.
B. Medium scale topographic maps, revised 1954.
1. Stereo controlled from 1957 aerial photography.
2. Planimetry revised from 1953 aerial photography.

SECTIONIZED TOW

6	5	4	3	
7	8	9	10	1
18	17	16	15	1
19	20	21	22	2
30	29	28	27	2
31	32	33	34	3

• INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.

S 13016 ~~RALLEY PROJ~~ RALI PROJ
Cut-lettering
Checked by J.R.Humiltie
SS/BMU 11/72

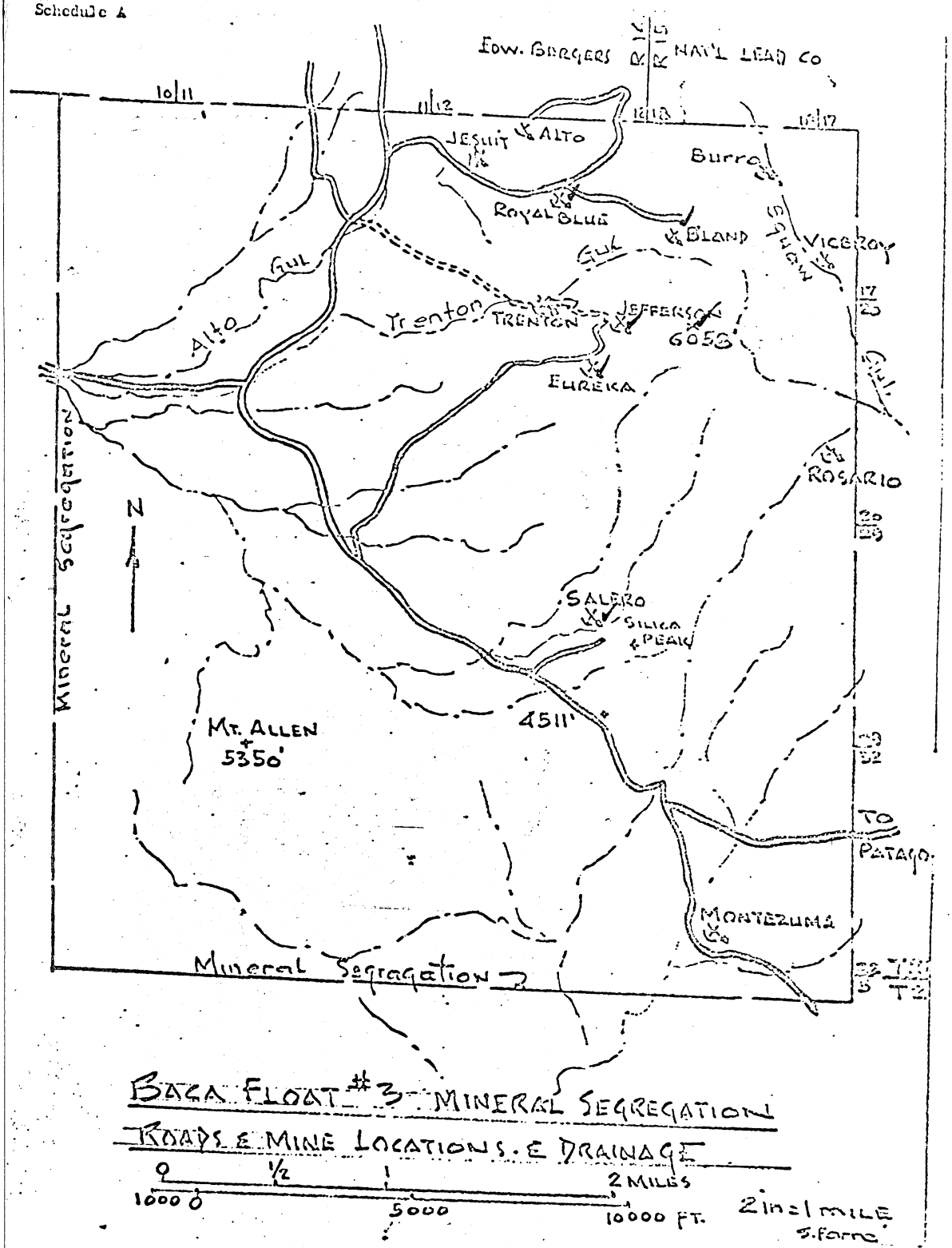
S 13016 ~~RALLEY PROJ~~ RALI PROJ
Landnet

S 13016 ~~RALLEY PROJ~~ RALI PROJ
Sec. Roads

13016 ~~RALLEY PROJ~~
Topo RALI PROJ

13016 RALI PROJ ~~RALLEY PROJ~~
Drainage

Schedule A



BACA FLOAT #3 MINERAL SEGREGATION

ROADS & MINE LOCATIONS & DRAINAGE

0 1/2 1 2 MILES

1000 0 5000 10000 FT.

2 in = 1 MILE

S. Forno

FRANK SCHRADER REPORT - USGS - 1915

MOUNT HOPKINS.

As noted under "Geology," the diorite at the head of the west fork of Madera Canyon, which composes the northeastern portion of Mount Hopkins and is intrusive into the granite, is cut by northwest-southeast faults. These faults have been the seat of metallization, and the minerals deposited are principally galena, pyrite, and chalcopyrite. They occur in the banded quartz and locally also impregnate the diorite next to the fissures. Where the veins or gangue are siliceous the principal ore mineral is galena, but where the gangue is composed principally of sheared diorite with little or no quartz chalcopyrite is the predominant ore mineral.

PLACER DEPOSITS.

The Madera Canyon alluvial cone, heading near White House and the foot of the mountains, at an elevation of about 4,500 feet, slopes northwestward toward Santa Cruz River and has a radial length of at least 5 miles. It is composed of gravels and sands discharged from the mouth of the canyon. These gravel deposits in places are probably over 100 feet in thickness and they all carry colors of gold. Toward the head of the cone an 80-foot shaft was sunk in them without reaching their lower limit. Below the road forks, however, 1 to 2 miles northwest of White House, the deposits are deeply trenched by recent gulches from 40 to 50 feet in depth, some of which cut through the deposits to the underlying bedrock granite, and here considerable gold placer mining was done with fair returns in the early days, mostly in the late eighties, water being brought from Madera Creek by ditch and flume.

Though not connected with the subject in hand, except geographically, it may here be mentioned that in this vicinity was found the 1,400-pound circular mass of native iron known as the Irwin-Ainsa meteorite, which is now in the United States National Museum at Washington.

TYNDALL DISTRICT.

GENERAL FEATURES.

The Tyndall district, the largest and one of the most highly mineralized districts of the area, occupies the western slope of the southern half of the Santa Rita Mountains (Pl. I, in pocket). It joins the Old Baldy district on the south and west and is almost wholly in Santa Cruz County. It extends from Madera Canyon, near White House and the county line on the north, southward to Sonoita Creek, a distance of 18 miles, and from the crest of the range on the east to the foot of the mountains and Grosvenor Hills, 6 miles distant on the west. Toward the south the crest of the range follows the ridge between Squaw Gulch on the west and Temporal Gulch on the east. The district contains about 110 square miles. A small part of it south of the Salero camp is still spoken of as the Aztec district and includes the old Aztec mine and some of the surrounding country.

The topography is varied and generally rough. The surface in the northern part of the district rises to Mount Hopkins, 8,072 feet, and Old Baldy, 9,432 feet in elevation. On the west the northern part of the border declines to 3,500 feet and the southern part to 4,000 feet. In the southwestern part of the district the general regularity in the slopes is interrupted by an irregular benchlike mass of hills, the Grosvenor Hills, averaging about 5,000 feet in elevation. Most of the district is accessible only by trail, but part of it is reached without difficulty by wagon, the drainage ways forming avenues of approach. At the time of visit the northern part of the district was reached by way of Santa Cruz Valley from Tucson or Helvetia, and the southern part by a good wagon road from Patagonia to Salero and Alto. At present most of the district is most easily reached from points on the branch of the Southern Pacific Railroad recently built between Tucson and Calabasas, which by bringing the railroad facilities within 4 to 10 miles of most of the mines has led to a general revival of activities along the west slope of the range. The district, as shown on the map, contains about 20 camps, mostly located on or near the drainage courses.

The district is occupied principally by a north-south belt of quartz diorite and quartz monzonite several miles wide on the east, bordered by granite on the north and overlain and flanked by the Tertiary volcanic rocks, chiefly andesite, rhyolite, and quartz latite porphyry, on the west. In the northwestern part of the district, in the Montosa-Caliente region, there is a relatively small belt of the underlying Paleozoic shales and limestones (Pl. II, in pocket).

LODE DEPOSITS.

Mineral deposits were first discovered in the district in the later part of the seventeenth century by the Jesuit missionaries, who worked the Salero, Montosa, and other mines. As explained on page 22, American activities began in the middle and late fifties of the last century.

The deposits, broadly described, consist of two main classes—argentiferous lead ores, which occur principally in fissure veins with a siliceous quartz-barite gangue in igneous rocks, and copper-silver ores, which occur similarly in fissure veins in igneous rocks and also as contact-metamorphic and replacement deposits, principally in the

limestone. Cerargyrite and copper carbonates are common in the rich vein croppings.

The district contains 40 or more mines and prospects, the most of which are given in the following list. Their general distribution is shown on Plate I.

Alto.
Apache.
Arizona-Pittsburg.
Aztec.
Blacksmith.
Bland.
Bradford.
Burro.
Camp Bird.
Connecticut.
Devil's Cash Box.
Elephant Head group.
Eureka.
Helvetia.
Hermit's Home.
Ivanhoe.
Jefferson.
Jenkins.
Jersey Girl.
John Allen.
Joplin.
Jumbo.
Mary and Polatski.
Merry Widow.
Montezuma.
Montosa.
Quantrell.
Rhode Island.
Rosario.
Royal Blue.
Salero (Darwin).
Santa Rita.
Silver Sally.
Tia Juana.
Three Star.
Treasure Vault.
Trenton.
Wandering Jew.
Viceroy.
Victor.
Vulcan.

The properties lie mostly on or near the main drainage courses, which deeply score the district transversely and issue westward into the Santa Cruz Valley. These courses, beginning on the north, are Chino, Agua Caliente, Cottonwood, and Josephine canyons and Squaw Gulch.

ELEPHANT HEAD GROUP.

Chino Canyon drains the outer portion of the granite area in the northwest corner of the district. From the shoulder-like manner in which the granite mass abruptly terminates in Pete Mountain, where it meets the lowland plains, it is known as Elephant Head. The upper part of the canyon, at about 1¼ miles from the edge of the mountains, widens into what is known as Chino Basin, and here, at an elevation of about 5,300 feet, is the Elephant Head group of 10 claims, also known as the Tremaine-Daniels group, after the former owners. The group has been worked more or less steadily in a small way for the last five or six years, and was recently purchased and is being operated on a larger scale by the Elephant Head Mining Co., with headquarters at Tucson. The group trends east-northeast on dikes of dense greenish-white porphyritic rhyolite cutting the granite and contains a number of good-looking prospects, mostly in the sheared and altered sericitized granite and associated with the dikes. The ores are principally lead-silver ores containing some gold and copper and in places a little zinc. The sulphides impregnate the granite very near the surface.

On the Quantrell claim, at the south end of the group, a 25-foot belt of altered sericitized granite stained by iron and copper carbonate,

with a 20-foot porphyry dike on the north, contains ore compo chiefly of galena, sphalerite, chalcopyrite, and pyrite, considera portions of which are said to average 1½ per cent in copper and ounces to the ton in silver.

On the Eureka claim, at the north end of the group, an 18-in quartz vein in the granite dips 80° N., is somewhat banded, a contains sericite, malachite, azurite, and chalcopyrite, a considerab portion of it constituting ore said to average 2½ per cent in coppe and 17 ounces in silver and $10 in gold to the ton. The 1,500-foo crosscut tunnel driven by the company is reported to have reache the vein, which here carries a considerable width of fair-grade ore. The ore is being shipped to the Pioneer smelter, and it is said that the installation of a dry concentrating plant is contemplated. Early in 1914 the company was reported to have installed a large concentrating plant and to be working a force of 125 men.

AGUA CALIENTE CANYON.

Agua Caliente Canyon heads in the rugged mountains next to Madera Canyon on the east, whence it extends mostly along or near the granite and diorite contact to the foot of the mountains, 4 miles distant on the west.

TREASURE VAULT MINE.

The Treasure Vault mine is located in the upper part of Agua Caliente Canyon at an elevation of about 6,650 feet. It was discovered in 1899 and is owned by the Santa Rita Mining Co., of Tucson. It is on a fault fissure which strikes N. 75° E. and stands about vertical in altered porphyritic diorite which is intruded by granite porphyry on the southeast. The diorite is fine grained and consists of andesine, hornblende, and orthoclase, with a little quartz, biotite, and magnetite. Next to the fault it contains phenocrysts of hornblende three-fourths of an inch in maximum length.

The fissure filling consists principally of about 4 feet of hard sheared and altered diorite and quartz. It is separated from the walls by a thin selvage. The ore contains mainly chalcopyrite, galena, tetrahedrite (gray copper), and sphalerite in association with quartz and some calcite. It occurs principally as pockets or stringers in the selvage and is only sparingly disseminated in the main filling. Some of it is said to average 18 per cent in copper and 100 ounces in silver and $20 in gold to the ton.

The mine is developed by two tunnels and a shaft. The tunnels are driven eastward in a ridge that separates the head forks of Agua Caliente Canyon. They are 80 feet apart vertically. The lower tunnel is 135 feet long, and from it a 30-foot crosscut has been

driven to the south. It makes considerable water, which is rapidly depositing limonite on the walls and floors. The shaft, which is 100 feet deep, is located 100 feet above the upper tunnel, which is 80 feet long and considerably caved.

BLACKSMITH PROSPECT.

The Blacksmith Prospect is situated west of the lower Treasure Vault tunnel, on the northwest side of Agua Caliente Canyon. It is opened by a shaft said to be on a vein parallel to that of the Treasure Vault mine, 20 feet to the south, but it is probably on the same vein. The upper part of the vein, at least, is similar to the Treasure Vault vein. The shaft, which was filled with water, is said to be 80 feet deep. It is reported that a great deal of ore obtained from pockets and stringers during sinking was shipped from this shaft.

HERMIT'S HOME.

The Hermit's Home claim, owned by A. E. Jenkins, is located in Rattlesnake Canyon, a north branch of Agua Caliente Canyon, at an elevation of 6,300 feet. It is on a diorite and granite contact zone containing considerable epidote with small pockets of quartz containing galena, chalcopyrite, and sphalerite. A fault dipping 80° SSW. in the coarse pink country-rock granite is associated with a foot of crushed silicified granite containing much white mica and a little disseminated pyrite, chalcopyrite, and chalcocite. The deposit is opened by a 130-foot tunnel on the northwest side of the canyon.

JENKINS PROSPECT.

The Jenkins prospect is located about a quarter of a mile south of Agua Caliente Canyon, at an elevation of 5,365 feet. It is on an east-west shear fault ledge in diorite and is apparently paralleled by a dike of granite porphyry 20 feet to the north. The ledge ranges from 6 to 50 feet in width. It carries gouge and soft, crudely banded ore containing drusy quartz, galena, pyrite, chalcopyrite, specularite, hematite, and sphalerite.

SANTA RITA MINES.

The Santa Rita property lies on the north side of Agua Caliente Canyon at an elevation of about 4,600 feet. It was located in 1900. A small stamp mill, now dismantled, was operated for a short time in 1907. From 1907 to December, 1908, test runs were made with two stamps by the Santa Rita Mining Co., of Tuscon. During this period, it is said, 385 tons of ore was tested and found to average $1.50 to the ton in gold. The concentrates 1 to 20 assayed 16 per cent

of lead and from $5 to $10 a ton in gold, but none of them w shipped. The gold caught on the amalgam plates was worth $1 an ounce. The average ore of the body, it is said, will run a 50 cents to the ton, but some of that at the surface and extend for a depth of 10 to 20 feet ran as high as $5. The pyrite conti below this depth but does not seem to contain recoverable gold.

DEVIL'S CASH BOX.

Toward the outer edge of the Montosa-Caliente belt of Pale sediments there is a monoclinal north-south foothill hogback r capped by limestone dipping 40°-60° W. into the Santa Cruz Va The ridge extends from a point near Agua Caliente to Mon Basin, being about a mile long, and is separated from the slope the main ridge by a narrow piedmont valley. From the min deposits found in it at various points it is known as the Devil's C Box. It was not examined in this work. Among the produc properties it is said to contain are the Orosco and the Shee O'Donnell. The Orosco, owned by J. M. Orosco, is said to lie at base of a limestone formation and to have shipped some very r silver-lead ore.

The Sheehy-O'Donnell mine, owned by Messrs. Sheehy and O'Do nell, of Tucson, is 5 miles east of Chaves station on the Tucs Nogales line of the Southern Pacific and 10 miles from the Pion smelter. It has made occasional shipments during the last f years, mostly to El Paso, and has recently been operated on a larg scale. It is opened to a depth of about 100 feet. The vein or lo is said to be 20 feet wide, and the mineralized zone in which it occ is said to extend throughout the length of several claims.

The ore is mostly lead-silver ore. The average of shipments m to the smelter is reported to be about $30 to the ton, but the ore i the deep part of the mine contains in places about 40 per cent of zin 22 per cent of lead, and 14 ounces in silver to the ton.

In September, 1914, the mine was bonded to a syndicate, which working it under the name O. K. mine and producing 20 tons a da of chiefly shipping ore. Forty men are employed under T. M. Par recently of the Elephant Head mine. Zinc ore as well as lead-silv ore is now produced, chiefly from a good lead-zinc showing along th limestone contact in the deep part of the mine. Some of the ore i hand sorted, and the zinc ore which is separated is shipped to Colo rado and Kansas for treatment. By September 15 seven cars of th ore had been shipped.

MONTOSA CANYON.

Montosa Canyon lies 1½ miles south of Agua Caliente Canyon. It heads on the upper west slope of Mount Hopkins, and in crossing the soft shale formation, about a mile before it reaches the foot of th

mountains, widens into Montosa Basin, in which are the Montosa mine and other principal openings of this drainage area. This part of the country, it is said, was worked by the Jesuit missionaries more than 300 years ago.

The first modern work in the region was done in 1876 by Clarke & Peterson on the heads of Montosa Canyon and of Josephine Canyon adjoining on the east, and much mining was done in the basin up to 1882. A number of claims are patented, among them the Pluto, on the east, and a number of others on the south, toward Josephine Canyon.

The basin is reached by wagon road ascending the lower part of the canyon from the west, and a trail leads from the basin up the canyon and across the divide to the head of Josephine Canyon.

MONTOSA MINE.

The Montosa mine is located in the southwesterly part of Montosa Basin and adjoining hills, at an elevation of about 4,900 feet and is easy of access. It is owned by Freeman & Smith, of Tucson. The property comprises a group of 14 claims known as the Montosa group. It was worked principally about 1901 and soon thereafter by Capt. John D. Burgess, of Tucson, for the Calabasas Copper Co. (Ltd.), with headquarters in New York City. The company did about 2,000 feet of underground work, mostly on the Isabella ground. It sunk to a depth of 250 feet and installed a 36-inch 30-ton water-jacket testing smelter. The smelter, however, was operated only 4½ days, but during that time $9,600 worth of bullion was extracted and a two days' run yielded considerable ore, carrying 47 per cent of copper. The ore in general averaged 8 per cent in copper, and the bullion, which was shipped to Ledoux & Co., of New York, carried about 360 ounces of silver and 3.1 ounces of gold. Some of it contained 16 to 20 per cent of lead and 30 to 45 per cent of iron (FeO).

The ore is said to have contained principally malachite, chalcopyrite, bornite, lead carbonate, galena, magnetite, specular hematite, and in places silicified green epidote. The iron oxides occurred principally in large masses intimately mixed with the malachite.

The company gave up the mine to the owner when its bond expired, in February, 1902, and since then no work to speak of has been done on it until recently.

The deposit is a replacement body in the Paleozoic limestone, which dips to the southwest. It is in the lower part of the limestone near its contact with the underlying shale. It trends about N. 70° W. and lies in a mineralized zone which extends at least one-eighth of a mile to the southeast and beyond which the limestone soon gives way to the overlying andesite that caps the mountains. The

intrusion of the andesite may be connected with the origin of the ore deposits, as is suggested by the fact that the andesite contains considerable magnetite, the deposits resembling in some respects those on Jackson Canyon, in the Old Baldy district.

A 30 by 40 foot open cut, the principal surface exposure, is about all in low-grade ore or bedded mineralized material. The entire mass is very ferruginous, containing magnetite and specular hematite, and the latter is the principal gangue mineral. The copper is represented by malachite, lead-copper oxide, and a little chrysocolla. Sulphides seem to be absent. The best part of the exposure is a 6-foot ferruginous bed that follows a slickensided footwall, dips 75° S., and seems to have been the chief source of the ore produced. It is composed principally of magnetite and specular iron and contains a little malachite, red copper oxide, and chrysocolla. About 40 tons of the ore is piled up on the ground, some of which is sorted for shipping, but it seems to contain little of value other than the iron. In the dump at the smelter the ore, which seemingly had been sorted, similarly consists mainly of malachite and azurite with a little chrysocolla and red copper oxide in a magnetite-specularite gangue. The deposit seems to contain a large amount of low-grade ore and can probably be profitably handled only if it is worked for iron as well as copper.

OTHER PROSPECTS.

About three-fourths of a mile north of the Montosa mine, seemingly on the Pluto claim, some relatively recent work has been done which includes a shaft 100 feet deep equipped with machinery. The deposit here seems to be in shale and greenish silicated limestone, and is probably associated in origin with intrusive andesite or diorite dikes which occur near by on the west.

COTTONWOOD CANYON.

Cottonwood Canyon, which lies 1½ miles south of Montosa Canyon, heads in the upper southeast slope of Mount Hopkins. In a spur on its north side at an elevation of about 5,900 feet are several prospects and two small producing mines from which ore, mostly copper carbonate, is packed down to the wagon road on burros and shipped. The country rock seems to be principally diorite underlain by limestone, which it intrudes, and capped by andesite. These deposits lie southeast of the Montosa deposits, to which their copper-stained croppings are said to be almost continuously traceable.

One of the mines, which is owned by John Allen, of Vance, Ariz., is opened principally by a 370 foot tunnel and 60 or 70 feet of drift, with 200 feet or more of [illegible]. The vein, which is about 3½ feet

wide, dips steeply to the southwest and has from 2 to 6 inches of gouge on the hanging wall. It is in diorite capped by andesite and is associated with two intrusive rocks corresponding to granite porphyry and lamprophyre. The vein consists principally of crushed country rock diorite and quartz and carries some ore. The ore minerals are chiefly chalcopyrite and pyrite. They occur in lenses, stringers, and irregular bodies associated with the quartz and they impregnate and replace the diorite in the vein. The mine makes a small amount of water.

JOSEPHINE CANYON.

Josephine Canyon heads south of Madera Canyon in the saddles on either side of Jack Mountain, between Old Baldy and Mount Hopkins, whence it extends southward for 4 miles and then southwestward for about 7 miles, leaving the mountains at the north base of the San Cayetano Mountains.

The mineral deposits are located in the upper part of the canyon. Here the topography is rugged and the surface well timbered. The country rock is mainly diorite and quartz monzonite.

Mineral deposits were discovered here in the early sixties. In the late seventies or early eighties a dozen or more claims were patented by eastern companies, which later learned that the claims would not pay to work in those days.[1]

MARY AND POLATSKI PROSPECTS.

The Mary and Polatski claims, owned by Martin Michelske, who lives on the ground, are three-quarters of a mile north of the township line in a small west fork of Josephine Canyon, at an elevation of about 5,300 feet. The main opening on the Mary claim is a 55-foot drift on a shear zone which dips 75° N. in dacite. This zone contains stringers of quartz carrying galena and chalcopyrite with some silver. Near the face of the drift the vein is cut off by a fault which hades 30° SE., and a crosscut 50 feet to the south has not yet recovered the vein, which is thought to be a continuation of the Rhode Island vein described below.

The Polatski ground, which is north of the Mary, is opened by a short tunnel driven in the granite beside a 6-foot quartz vein that strikes N. 60° E. The quartz is iron stained, and where opened by a 60-foot drift the vein shows a little chalcopyrite coated with chalcocite.

RHODE ISLAND MINE.

The Rhode Island mine is five-eighths of a mile upstream north-northeast from the Mary and Polatski claims, on the east side of Josephine Canyon, about opposite the Tia Juana cabin, where the

trail to the Tia Juana mines leaves the canyon. It is on a 4-foot quartz vein in dacite, with about a foot of gouge on the hanging-wall side. It and the adjoining Connecticut property, owned by R. R. Richardson, were discovered in 1895, and a small adobe smelter was built to treat the ore. In recent years only assessment work has been done. It is opened by a 100-foot drift and a 60-foot shaft in which the vein for the entire length shows oxidized iron and copper stained quartz containing azurite, malachite, chalcopyrite, galena, pyrite, specular iron, a little chalcocite, and in places some zinc blende; it contains also some silver and gold. Chalcopyrite is said to be the principal ore mineral. A carload of ore shipped to the El Paso smelter in 1903 is reported to have carried 11 per cent of copper, 3 ounces in silver, and $2 in gold to the ton, and a little lead and zinc. About 50 tons of good-looking ore lies on the dump.

CONNECTICUT MINE.

The Connecticut mine, adjoining the Rhode Island, is on a fault or shear zone ledge which dips steeply to the south, in diorite. It was worked mostly in 1895-96, when about 300 feet of work was done and several tons of ore was treated in the adobe smelter built on the ground. Since the acquisition of the property by the present owner, in 1900, only the annual assessment work, which aggregates about 300 feet, has been done. In 1904 and 1905 two carloads of ore, principally from the main or upper tunnel, were shipped to the El Paso smelter and averaged 22 per cent of copper and 15 ounces in silver and $1 in gold to the ton. The ore contains no zinc or lead.

The property is opened by a 240-foot drift 110 feet above the bottom of the canyon. Along the middle 150 or 160 feet of the drift are upraises and stopes, which produced most of the ore, and here the ledge or vein, 4½ feet wide and consisting of crushed and altered mineralized rock and quartz, contains ore, mostly in bands or stringers, interruptedly all the way across and for 90 or 100 feet along its course. Also through the middle two-thirds of the drift extends a later 2 to 6 inch band or vein of ore which dips transversely to the north-northeast and is best exposed in the upper right wall and adjoining part of the roof. The ore in this vein contains chalcopyrite, malachite, and iron oxide, with a little bornite. The drift seems to be driven on the junction or horizontal intersection of this vein with the main ledge. Toward the face of the drift this vein straightens up and is represented only by a 2 or 3 inch band of gouge containing a little sparsely disseminated pyrite and chalcopyrite on the right or hanging wall side. In a cut 40 feet above the drift it seems to be represented by stringers and a lens of ore about 6 inches in maximum width. Toward the [illegible] of the drift horizontal grow

indicates that considerable lateral movement has taken place. The drift is partly timbered and is somewhat caved.

In the lower drift, which is 110 feet below the main drift just described and but 3 feet above the bottom of the canyon and has a length of 80 feet, the ledge is composed mainly of closely sheeted, sheared, and partly altered diorite. Some slices are less than a quarter of an inch thick, and along the sheeting planes are seams or stringers of oxidized ferruginous material. In the right face of the drift is shown about 2½ feet of altered iron and copper stained rock and quartz containing some chalcopyrite and specular hematite.

During 1912 and 1913 Hogan & McCutcheon worked the mine under lease and are said to have sunk it to the depth of nearly 400 feet and shipped many carloads of fine copper ore that yielded about $1,600 each. In September, 1914, it was reported that the mine was being worked by Tate & Gartley, of Bisbee, who were taking out silver ore only and leaving the copper ore in the stopes until more settled times.

PROSPECTS NEAR CONNECTICUT MINE.

About a quarter of a mile northeast of the Connecticut mine, above the mouth of the east-side gulch, at an elevation of 5,530 feet, or 120 feet above the floor of the canyon, is a 2-foot faulted shear-zone ledge dipping steeply to the south-southeast, in diorite, which is opened by a 150-foot drift and 30 feet higher up the slope by a 45-foot cut with a 20-foot face. From both of these workings seemingly good oxidized copper ore has been taken out. The ledge, which contains but little quartz or sulphides, consists mainly of sheeted or crushed altered country-rock diorite, largely replaced by the ore minerals malachite, azurite, and oxide of iron. The ore occurs in lenses, the largest of which is about 2 feet in width. Several tons of good-grade oxidized copper ore lies on the dump. The hanging wall shows both approximately vertical and horizontal slickensiding.

As no other intrusive rocks were observed in the vicinity it seems likely that the deposits of the Rhode Island and Connecticut mines and of the neighboring prospects may owe their origin to thermal solutions that accompanied and followed the intrusion or eruption of the dacite at the locality of the Rhode Island mine.

CAMP BIRD PROSPECT.

The Camp Bird prospect is located in the main canyon about a mile above Tia Juana cabin and a mile northeast of the United States location monument. It is opened by a 10 foot shaft sunk on

a tight southward-dipping fissure in granite. The walls are imp nated with disseminated pyrite and chalcopyrite in moderate amo

TIA JUANA MINE.

The Tia Juana mine is located in the west side of Josep Canyon three-fourths of a mile from the stream channel, betw elevations of 6,100 and 6,800 feet, in the high, prominent nar ridge which separates this canyon from Cottonwood and Mont canyons on the west. It is but a quarter of a mile from the cen head fork of Cottonwood Canyon and 1½ miles from the near Montosa drainage way. The topography is rugged. The mine i a parallel gulch in the steep, cliff-like face of the ridge which vein crosses (Pl. I), and is reached by trail from Tia Juana cab The country rock is diorite, in which there is a strong quartz fiss vein which stands vertical, is about 14 feet in width, and ha known length of about 2½ miles. Its course across the country well marked by a reddish-brown belt of croppings and their result débris. The vein strikes N. 85° W. and extends from Josephi Canyon westward across Cottonwood Canyon and into Mont Canyon, 1½ miles above the mine and Tia Juana ridge. The Mont mine, though 3 miles distant, lies directly on its course, suggest that the two deposits, though possibly not connected, may be on same general fault or fissure.

The croppings, which in places rise boldly 20 feet above the s face, consist almost wholly of quartz, stained reddish and d brown by limonite, manganese, and copper carbonate. The qua occurs mostly in multiple-banded parallel reefs with a small amo of altered mineralized rock. In places the vein is crossed by nearly vertical sheeting and slickensiding showing both vertical horizontal movement to have taken place along the vein. On north slices of the country-rock diorite several feet in thickn dipping to the northeast, are separated by a few inches of gouge.

The vein was discovered in the early sixties, and from openi on its end in Josephine Canyon, in the flats, pioneer prospectors ch rided considerable very rich ore, much of which averaged, it is s more than 1,200 ounces in silver to the ton. In 1902 the ground acquired by the present owners, who have patented three (the Sa Maria, Tia Juana, and Santa Cruz) of the five claims and doing more than the required assessment work on the other tw Figures giving the amount of production, which was n charge, not available.

On the Tia Juana ground the vein is opened by cuts, drifts, cr cut tunnels, and shafts aggregating by estimate at least 500 f

of work, distributed at intervals throughout a distance of nearly 2,000 feet and a vertical range of about 600 feet, as shown in part in figure 19. In these openings the vein ranges from 10 to 40 feet in width and exhibits in cross section considerable variation in the filling. It is generally separated from the north wall by a 1-foot sheet of gouge, and this is succeeded by 2 to 8 feet of white, iron-stained, mostly massive quartz, which contains chalcopyrite, pyrite, and galena with some copper carbonates and chalcocite sporadically distributed, mostly in small pockets and disseminations, and a considerable part of which constitutes low-grade ore. The southern part of the vein consists chiefly of crudely banded crushed, altered,

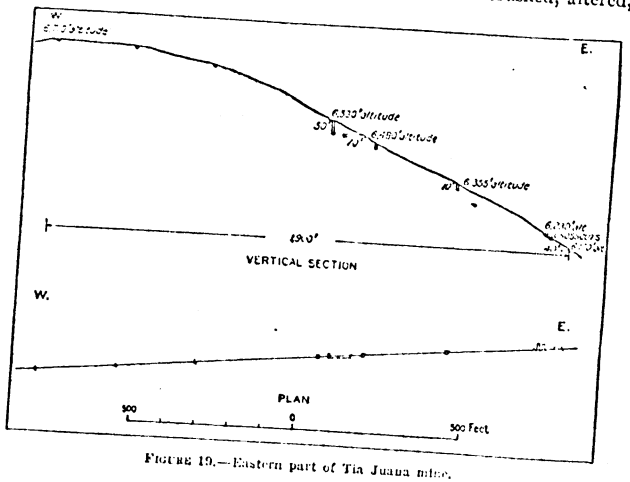


FIGURE 19.—Eastern part of Tia Juana mine.

brecciated, and mineralized diorite, locally silicified and containing veinlets, stringers, and lenses of mineral-bearing quartz, the whole being more or less impregnated with pyrite, chalcopyrite, galena, and some copper carbonates, and much of it constituting ore of concentrating grade.

On the Cottonwood Canyon side of the ground about 800 feet west of the divide and 300 feet below it, on the Tia Juana claim, the vein is said to fork or give off a strong spur which deviates obliquely from the main vein, taking a more northerly course, and at the forks the vein has a reported width of 40 feet. It has been recently opened by a 120-foot drift and crosscuts. On the north or hanging-wall side, near the surface, it contains large bodies of

ore consisting mainly of carbonates of copper and lead with considerable silver and some gold, and at greater depths good bo composed principally of chalcopyrite and galena in a quartz gan appear.

The Tia Juana vein is large and persistent and seems to con considerable ore, but it should be worked with due consideration the low grade of the ore and the more or less sporadic manner which it occurs. Where opened near the middle of the slope a 50-foot drift and crosscut, the vein is composed mostly of crud banded, oxidized, altered, and mineralized rock and quartz, some which is considered low-grade ore, and it contains fine to medi grained specularite, malachite, azurite, a little pyrite, chalcopyri molybdenite, galena, and sphalerite. Here about 10 tons of fai looking, mostly oxidized ore lies on the dump, and several tons similar ore lies at each of two other openings.

SALERO AREA.

GENERAL FEATURES.

The Salero area joins the Josephine Canyon area on the sou extending in a belt about 3 miles wide southward for 6 miles to south line of T. 21 S., R. 14 E., near the Grosvenor Hills. It li mostly near the eastern border of this township and includes in southern part the historic Salero camp and mine. The other pri cipal camps, whose distribution is shown on the map (Pl. I. pocket), beginning on the north, are the Arizona-Pittsburg, Wande ing Jew, Alto, Trenton, Burro, Bland, and Hackett.

The topography of the area is mountainous in the eastern par Elsewhere it is mostly rough and hilly, but the western middle par centering about Wise's ranch is comparatively open. It is drain principally by an eastern branch of Josephine Canyon, known a Ash Canyon, whose head tributaries reach to the ends of the belt o the north and on the south. A narrow portion of the belt on th east drains southward through Squaw Gulch into Sonoita Creek.

The central part of the belt, about 1½ miles wide, with the north south township line near its middle, is occupied by diorite an quartz monzonite, which on the west are overlain by Tertiary vo canic rocks—quartz latite porphyry, dacite, rhyolite, and andesite— and to the southeast, on Squaw Gulch, are succeeded by a north-south belt of intrusive granite porphyry. The mineral deposits occur in veins which strike west-northwest and are contained mostly in the quartz latite porphyry, diorite, and quartz monzonite.

The area contains half a dozen mines and a score or more of good-looking prospects, many of which are productive on a small scal

They are mostly in or near the northeastern part of the township and are listed below.

Alto.	Helvetia.	Royal Blue.
Apache.	Jefferson.	Salero (Darwin).
Arizona-Pittsburg.	Jersey Girl.	Three Star.
Aztec.	Joplin.	Trenton.
Bland.	Jumbo.	Wandering Jew.
Bradford.	Merry Widow.	Viceroy.
Burro.	Montezuma.	Victor.
Eureka.	Rosario.	Vulcan.

A drawback of some of the ores of this area is the mixture of the metallic minerals—for example, lead, copper, zinc, silver, iron, and molybdenum—which renders treatment or final separation of the metals difficult and expensive.

SALERO MINE.

The Salero mine (also known as the Darwin and later as the Constitution mine) is located in the southern part of the area, 7 miles northwest of Patagonia. It is among the oldest mines in the region, the deposit having been discovered by the pioneer Jesuits in the seventeenth century. It was worked about 1828 to 1830 by the Tumacacori missionaries, and later by Mexicans. In 1856 or 1858 John W. Wrightson, of the Cincinnati Enquirer, and his brother became the next owners. They sunk a 75-foot shaft and opened some drifts. About 1858 the mine passed into the hands of the Salero Mining Co., of Cincinnati, Ohio. From 1858 to 1861 Tubac was the company's headquarters. Its leading men were John W. Wrightson, manager; H. C. Grosvenor, an Englishman, engineer; Gilbert, superintendent; Hopkins, mineralogist; and R. Pumpelly, geologist. All these men except Pumpelly were killed by the Indians, and in 1865 the company retired.[1]

During and after the Civil War the mine lay idle until it was relocated by John E. McGee for an English corporation, but as the mine was on the Boca Float No. 3 grant, which could not be held, it was relinquished. Early in the seventies, in the lead-silver days, it was relocated by George Clark, of the Peterson & Clark firm, who after working it to some extent bonded it to the Kranz brothers, of Sonora, Mexico. Later Clark and his partner Peterson worked it themselves, took out and shipped $10,000 worth of ore, mostly from old workings at about the 60-foot level, and, it is said, left 1,500 tons of second-grade 12-ounce silver ore on the dump.

About 1897-98 the mine was worked by John Wier, of New York City, who sunk a 300-foot (?) shaft on the property and did con-

[1] Ferris, R. J., Hoole, S. C., of Arizona, p. 204, San Francisco and New York, 1878.

siderable drifting. About 1900 Peterson & Clark sold the mine for $15,000 to the Salero Mines Co., of which C. H. Ferry, of New York, and W. P. Blake, of Tucson, were the leading men. This company began to develop the mine in 1902, started the new shaft in 1904, and installed the present substantial machinery and enlarged the shaft to a two-compartment shaft in 1908. At the time of visit the company was drifting east and west on the 400-foot level and running crosscuts. Recently, since Mr. Blake died, Mr. Ferry is

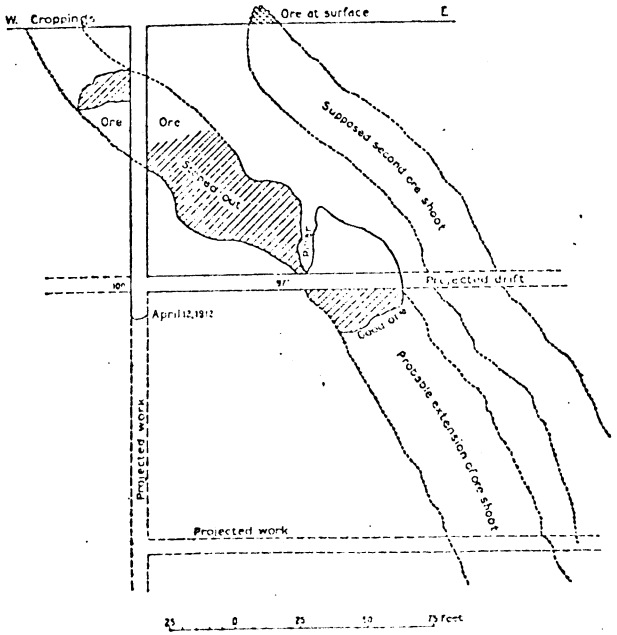


FIGURE 20.—Longitudinal section of west shaft workings, Salero mine.

said to have become the sole owner of the mine. The property comprises a group of several claims, among them the Eureka and Thunderer, both patented and said to have much ore blocked out in the ground.

The mine is opened mainly by two shafts 411 feet apart (Pl. XIV), drifts and crosscuts aggregating about 2,000 feet of work. The east or Darwin shaft is a double-compartment shaft 400 feet to the

400-foot level, where drifts are run 150 feet to the east and west with crosscuts spaced 25 feet apart. The old or west shaft has 150 feet of drift on the 100-foot level and 200 feet on the 160-foot level (fig. 20).

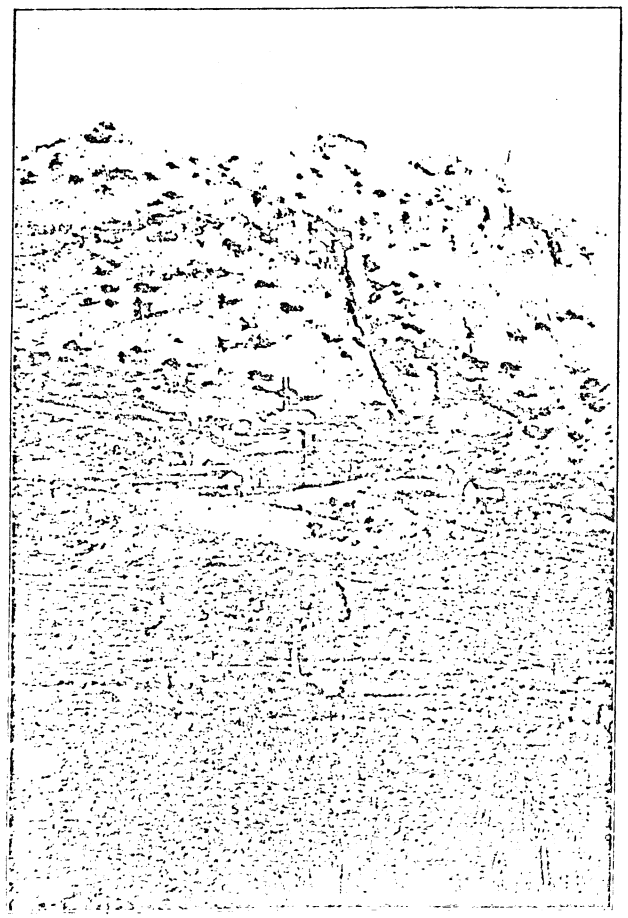
The mine is well equipped and at the time of visit the company was working 20 men.

The topography is relatively gentle. The mine is located just north of Salero camp, at an elevation of about 4,650 feet, in the southwest base of Salero Hill, which overlooks open-valley country on the south that drains northwestward into Josephine Canyon (Pl. VII, *B*).

The country rock in general is the quartz diorite, but at the mine, as seen in the footwall on the surface at both shafts and in both walls on the 400-foot level, there is a fine to medium grained acidic rock standing between aplitic granite and granite porphyry. It is intruded and overlain by fine-grained altered quartz diorite, or possibly andesite, which occurs in the hanging wall, as is well shown at the old shaft, and in places it is banded and has a tuffaceous appearance. The country is considerably faulted; one fault on the property has a reported throw of 300 feet. Water was first encountered in the mine in crosscutting the vein on the 140-foot level, and from this level down to the 400-foot level the mine makes about 20,000 gallons of excellent potable water in 24 hours. Ground water is thought by the operators to stand at depths of 120 to 130 feet, where more water was encountered than at any other depth in the mine.

The deposits are chiefly silver-copper ores contained in a quartz vein which strikes N. 65° W. and has a reported length of about 4 miles. One vein is in general well defined, the croppings in places rising boldly 20 feet above the surface. On the Salero ground it dips 75° SSW. or stands nearly vertical and ranges from 10 to 30 feet in width. The country rock, especially on the footwall, is sheeted about parallel with the vein and both the vein and the country rock are closely sheeted or cleaved by structure planes dipping 80° SE., which is obliquely across the dip of the lode.

The croppings where best exposed at the west shaft have a width of 12 feet and rise from 5 to 20 feet above the surface. They consist mainly of quartz which is more or less crushed, somewhat laminated, and drusy. The quartz is mostly whitish, but much of it is greenish, some is stained brownish or reddish and black by iron and manganese, some purple as if by fluorite, and some red speckled, perhaps by ruby silver. The last 2 or 3 feet of the quartz on the hanging-wall part of the vein is dull greenish and impure, being flinty or cherty, and is separated from the wall rock by 2 feet of



ALTO MINE, CAMP AND HILL.

variously streaked and iron-stained crushed rock and quartz that form a breccia-like gouge.

In the old shaft the vein is said to be 24 feet wide. The gangue is practically all quartz, and the vein carries a good ore shoot which, as shown in figure 20, pitches about 45° E. and is known to extend from a point near the surface to the 160-foot level, where the 200-foot drift extending east of the shaft, driven partly in the hanging-wall and partly in the footwall side of the vein, is continuously in good ore for 75 feet. The hanging-wall side of the vein usually carries from 1 to 2 feet of "talcose" gouge, but on the footwall side the quartz rests directly on the solid wall rock, and here most of the ore occurs.

The ore of the mine is chiefly silver-copper ore, whose value lies almost wholly in silver. It shows a tendency to be associated with the greenish quartz, which, on the 100-foot level, is more or less crushed and brecciated and in part laminated and drusy. The ore minerals are principally argentite and chalcopyrite, with also a little copper carbonate and a very little galena; pyromorphite is reported. In the surface ores occurred also considerable horn silver, or cerargyrite.

The drifts now being run on the 400-foot level are all in whitish and greenish, more or less iron stained quartz, which is as a rule barren. No ore has been encountered in the east drift, but the west drift has just passed through a so-called lens of quartz extending obliquely across the vein in an easterly direction. This lens is 10 feet or more in width and shows considerable red and brown iron stained material, some stained by malachite and azurite, and some black silver (?) sulphide. Much of the quartz has been crushed, shattered, laminated, and recemented. The country rock, on the footwall at least, is very close and tight, rendering it difficult for mineral deposits to form in it. Between the shaft and the vein, however, which are 90 feet apart, at a point about 14 feet from the shaft, occurs a fault marked by a sheet of gouge 1½ feet wide, dipping 80° S.

Sold - ALTO MINE.

Location and topography.—The Alto, formerly the Gold Tree and later the El Plomo mine, is located 2¼ miles nearly north of Salero, mostly in the SE. ¼ sec. 12, at an elevation of about 5,400 feet. It is in rough, hilly ground in Alto Hill, which, however, overlooks an open valley on the southwest (Pl. XV) that forms a natural approach to the mine and camp, the camp being at the foot and the mine mostly in the upper part of the hill, which rises 300 feet above the valley. The hill was named El Plomo by the early Spaniards, from the lead minerals occurring in it. It is merely a

MINERAL RESERVATION - DEED TO DOUGHERTY
& PENDLETON - BACA FLOAT.

There is situated in the northeast corner of said north half of Baca Float what is known as the Mineral Segregation, believed to contain approximately 8,656 acres, more of less, and described as follows:

"Beginning at the Northeast corner of Baca Float No. 3, running thence along the east boundary line of said tract 20,312,18 feet to Baca Float Mile Post No. 46; thence West 18,678 feet to southwest corner of said Mineral Segregation; thence north 20,184.18 feet to the north line of Baca Float No. 3; thence along said north line 18,687.24 feet to the place of beginning."

Out of and from this conveyance there are excepted and reserved unto Party of the First Part, its successors and assigns, all mines and minerals of whatsoever nature lying in or under that part of the land hereby conveyed and hereinbefore mentioned as the Mineral Segregation, together with full liberty at all times to Party of the First Part, its successors and assigns, its and their agents and workmen, to enter upon all or any part of said Mineral Segregation and hereditaments, to search for, work, get and carry away said mines and minerals, and any mines and minerals in adjoining lands Party of the First Part, its successors and assigns may hereafter acquire, to let down the surface of all or any part of said Mineral Segregation and any buildings new or hereafter to be erected thereon, and for the purpose of such working to sink pits and shafts and tunnels, erect buildings, construct railways, tramsways and roads, railroads, aerials, lay pipe, make aquaducts and water courses and appropriate and use the surface of said Mineral Segregation hereby conveyed, or any part thereof, for refuse heap, dumps, mill sites, residences, tanks, stores or commissaries, schools, smelters, churches; use any and all water now developed or hereafter developed on said Mineral Segregation; to sell to others any water now on or hereafter developed on said mineral Segregation to be used in mining operations, and to do any and all other things convenient or necessary for the full enjoyment of the exceptions and reservations herein contained.

There is also reserved the exclusive right to operate any and all commissaries and stores on said Mineral Segregation and to erect any houses that may be necessary and convenient for the operation of such commissaries and stores. There is also hereby reserved for the use of aforesaid Mineral Segregation for mining purposes a right of way for necessary proper and convenient ingress and egress from any mine or mines being operated on said Mineral Segregation.

There is also reserved to Party of the First Part, its successors and assigns, the right to retain possession of the buildings on what is known as the Salera Camp and the small pasture now fenced around the camp which camp and the small pasture are to be used only as a mining camp and a pasture for such stock as is necessary for the accommodation of those occupying the camp. The right to use this camp and small pasture is simply an incident to the operation of the mines and rights reserved on the Mineral Segregation.

Patagonia, February 17, 1956

Salero Metals Corp.,
Patagonia, Arizona

Gentlemen:

During the summer of 1948, I performed a good deal of work for you on the Mineral Segregation and spent some time thereon with the late J.S. Coupal, Mining Engineer. We issued separate reports dated August, 1948.

Since that time I have done much work, both underground and surface, on various parts of the Mineral Segregation and some of its old workings.

None of the data or information that I have since obtained has altered my expressed opinions, which have been confirmed in part by additional work performed by me, and additional test work done on the property, including a new 70-foot shaft east of the upper workings of the Alice Mine, from which two carloads of copper ore were shipped to the ASAR Smelter at El Paso, Texas. From data in my files, the lower drift-tunnel at the Jefferson Mine has been driven to within about 60 feet of the old workings, where local miners well-known to me have reported good lead ore to remain.

In connection with the abovementioned work, I have prepared plans and estimates from underground surveys of the accessible workings of the Bland and Jefferson Mines, showing probable costs of developing and operating these mines. It is my opinion that both of these mines contain sufficient metal-bearing ore, at current prices, to justify the development of them as planned, and I believe that, with proper operation, made possible by suitable equipment and adequate working-capital, that each of said mines would be profitable. In my opinion, other ore-veins and old workings on the 2,785 acres within the sublease owned by the Salero Uranium Mining Co., merit exploration, development, and operation.

The new roads built on your property, plus the improvements made on the County Road from Patagonia, render the abovementioned mines more readily accessible, and recent substantial increases in base-metal-prices further enhances the values of mining properties.

Although no commercial deposits of uranium are now known to exist on the Mineral Segregation, the favorable reactions reported to have been observed on radiation-detection instruments within the property, and in the vicinity thereof (plus the factthat the geological ages and formations are favorable to the deposition of uranium) make it not unreasonable to expect satisfactory results from proper exploration and test-work seeking such deposits on your property. However, it is my opinion that the contemplated development and operation of the known ore-bearing veins containing other metals makes it probable that your properties will be profitable.

Sincerely,

Robert Lenon, Reg'd Mining Eng'r
Arizona Certificate No. 1221

JEFFERSON MINE PRODUCTION (SUMMARY)

YEARS	DRY TONS	GOLD oz	SILVER oz	LEAD %	ZINC %	COPPER %	TOTAL PAID	PAID PER TON	METALS AT:
1923-4	41[illegible].966	0.03[a]	7.85	3[illegible].7	----	----	$ 15,2[illegible]9.77	$36.[illegible]	Lead: 8¢[a]
1925	4[illegible]3.[illegible]71	0.04[a]	7.68	27.4	----	1.5[a]	14,719.60	30.40	Lead: 9¢[a]
1926-8	330.792	0.03[a]	7.05	31.5	----	1.0[a]	8,070.37	24.40	Lead: 8¢[a]
1941-2	232.563	0.03	6.20	25.5	----	0.4	3,518.83	15.10	Lead: 12¢[a]
1945	889.035	0.01[a]	1.75	10.0	----	0.1	1,229.08[b]	1.38	Lead: 6.5¢
1946-9[c]	1252.808	0.01	1.50	8.7	2.3	0.1	14,217.70	11.35	Lead-Zinc: each 10¢[a]

a: Approximate figures (incomplete data, or estimated)
b: Includes 5 lots (about 250 tons) at a net loss of $133.90
c: All preceding ores to El Paso and Douglas Lead Smelters; these years to Sahuarita (mainly), and Trench and Shattuck-Denn custom-mills
All data autrarized from existing settlement-sheets on file

1946-47

REPORT ON THE TRENTON-EUREKA AREA by Robt Lemon
(Approximately 85% of total acreage)

The area covered by this report consists of 2365 acres in the Northeast corner of the Mineral Segregation of the Baca Float No. 3, and is a tract about 6,660 feet in a N-S direction, and 15,840 feet in an E-W direction (see sketch).

The actual mineralized ground covers the eastern half of this area, so far as is now known, the western half being largely covered with tufa and valley-fill so that the nature of the underlying formations is undetermined.

The mineralized area contains a series of vertical and near-vertical veins lying within walls of granite-porphyry and quartz-diorite. The known veins number 12, beginning at the north, the North Bland, Bland, Royal Blue, Alice Blue, Navy Blue, North Trenton, Trenton, Jefferson, Georgia, Trudie, Eureka, and Marble.

Each of these veins has had a considerable amount of work done on them, with the exception of the North Bland, Navy Blue, and the Georgia. Each has produced considerable quantities of high-grade ore, with the above-noted exceptions. The character of the ores produced is quite varied, ranging from high-silver surface ores through many classes to mill-rock containing copper, lead, and zinc values.

The major portion of the work mentioned above has been done over a period of about sixty years, mainly by small operators working without adequate capital and without an overall coordinated plan. As a result, there is little positive ore to be seen, and a prospecting and development campaign is necessary to prove the worth of the ground.

Three lessees are now operating in various parts of the property, on the Bland, 3 Royal Blue, and 2 Jefferson. Of these the first two are shipping ore to smelters and custom mills, and the third is driving a crosscut tunnel to a parallel vein (the Alice Blue) known to have been productive on the surface. These mines will eventually be operated by the Company and need not be considered as separate properties in an overall analysis.

The properties are reached by a fair county road skirting the foothills west of the mineralized area. It is about twelve miles to the shipping point of Patagonia over this road, and the several properties require hauling over from one to two miles of fairly steep mine-roads before reaching the flat, all grades being in favor of the load.

An abandoned connty road leads to Carmen and Tubac on the Santa Cruz River and the S.P.Ry, a distance of some twelve miles. This road ~~is now practically~~ crosses terrain much more favorable than the present county road to Patagonia, and, being now in a fair state of repair, could be easily rehabilitated for trucking to the railway or to the Eagle-Picher custom mill at Sahuarita, some thirty miles north of Tubac via paved highway.

North Bland Vein: This vein has been but little developed, but lessees are now driving a crosscut tunnel to hit it at a depth of 100 feet below the outcrop at a point across the canyon (north) from the Bland Tunnel.

Bland Vein: This vein, which ~~probably extends~~ can be traced east a mile to the Viceroy workings and west an equal distance to the Jesuit workings, is a deposit of considerable merit. It is developed by an aggregate of about 2,000 feet of tunnel, mostly drifting along the vein at two levels ~~100 feet apart vertically~~ at elevations of 5400 and 5500 feet. Values are in lead, zinc, copper, and lead, and shipments are now being made to the Eagle-Picher Mill at Sahuarita by leasers.

Royal Blue Vein: This vein is developed to a depth of over 100 feet by tunnels and a shaft, and has been cut by a crosscut tunnel at a depth of over 300 feet below the outcrop. Drifting on this level disclose ore over a length of over 350 feet. Values are in gold, silver, lead, zinc, and copper, and shipments have been made recently to the Sahuarita mill by leasers.

Alice Blue Vein: This vein, some 250 feet south of the Royal Blue vein, has been developed to a depth of over 200 feet by a drift-tunnel, shaft, and winze, and has produced considerable copper-silver ore of good grade. At the present time the Royal Blue ~~tunnel~~ is being driven to intersect this vein at a depth of 200 feet below the drift-tunnel mentioned above. With about 75 feet to go this vein should be cut by August 1, 1947.

Navy Blue Vein: This vein has been little-developed, and no ore of any consequence has been taken from it.

North Trenton Vein: This vein is about 300 feet north of the Trenton vein, and has had several dozen pits, shafts, and open-cuts sunk on it along the 1500 feet where it is most exposed. High-grade copper-silver ore was taken from practically all of the workings which extend to a depth of possibly 80 feet. Just north of the Trenton Shaft this vein splits or a cross-vein cuts it, and shafts have been sunk on these branch-veins to depths of over 50 feet.

Trenton Vein: This vein has been worked to a depth of 150 feet at the Trenton Shaft and several carloads of high-grade lead-silver ore have been shipped from workings extending east and west of the shaft more than 100 feet. This mine was flooded

by a heavy rain which filled the canyon above the collar of the shaft and ~~ruined the latter~~. As the mine was operating at the time this happened it is presumed that the rumor that there is still ore in the lower workings is correct.

Jefferson Vein: This vein may be an offshoot of the Trenton vein, or the southern branch of same. The area between the two workings, some 1000 feet in length, is covered with detritus and the veins are not traceable without trenching. Leasers are shipping lead-silver-zinc ores to the Trench mill near Harshaw at the present time. This ore is coming from the 100-foot level of the 200-foot shaft, and they have recentlyrepened the tunnel at the collar of the shaft which extends eastward 300 feet.

The Jefferson vein is developed by tunnels at three elevations, 4,993', 5,167', and 5,410', aggregating over 1000 feet of work, mostly drifting. The face of the lower tunnel is caved and is inaccessible, the middle tunnel contains considerable ore, and the upper tunnel has a fine showing of lead ore throughout its length. The upper tunnel has no road or good trail leading to it, and is not being worked for that reason; it lies on a southern branch or offshoot of the Jefferson vein proper.

Georgia Vein: The Georgia vein lies south of the Jefferson vein about 200 feet. It has been little-developed, and no ore of any consequence has been shipped from it.

Trudie Vein: The Trudie Vein has been developed by tunnels on three elevations with a total length of some 500 feet. It is about 350 feet north of the Eureka Vein, and very little stoping has been done on it, possibly because of the zinc content of the ores observed.

Eureka Vein: The Eureka Vein has been prospected by a series of open-cuts, shafts, and drift-tunnels for a length of half a mile. It has been developed by a crosscut tunnel at an elevation of 5,052 feet which hit the vein about 100 feet from its portal. At this elevation drifts were run eastward some 900 feet and westward about 30 feet. Various raises and stopes have found ore in a series of shoots, and little is now visible. Underhand stoping (now backfilled) was rather extensive, and production consisted of several carloads of high-grade lead-silver ores. Near the crest of the ridge to the East an 80 ft shaft has been sunk on the vein, and beneath it a raise has been put up from the tunnel-level an estimated distance of 80 feet. This raise is untimbered, but in good shape, and it is estimated that about 140 ft of raising would be required for a connection.

Marble Vein: The Mrrble Vein was prospected on the surface, but little ore appears to have been taken therefrom. It was cut at a depth of some 175 feet below the outcrop by extending the Eureka crosscut tunnel a distance of about 200 feet. At that point mill-ore was encountered and drifted on 80 feet east and west, but no shipping-ore was found.

Proposed Plan of Development

It is proposed to develop the most-promising showings with a view to a corellated operation and future erection of a ~~XXX~~ centrally-located mill.for treatment of the various ores. The plan calls for a camp-site (and future mill-site) at the mouth of Trenton Gulch at an elevation of about 4700 feet. This site is easily accessible by repairing an existing road, with easy grades a distance of one-half mile from the county road.

The most-favorable veins to be operated and developed from this setup are, respectively: North Trenton, Trenton, and Jefferson, & [illegible] This work to be done as follows; using portable equipment and keeping the plan flexible to allow for contingencies:

1. Driving a drift-tunnel eastward along the North Trenton at an elevation of 4730 feet (see map, existing portal at that point) and connecting with the bottoms of the deeper shafts along the vein as the work proceeds.

2. Driving a drift-tunnel eastward along the Jefferson Vein at an elevation of 4,800 feet so as to have a connection with the present workings when the ~~present~~ term of the present lease expires.

3. Extending the Eureka Crosscut tunnel (Elev. 4834) to intersect the Eureka vein, probably less than 100 feet.

4. Driving a ~~drift~~ crosscut-tunnel at Elevation 4950 to hit the Eureka vein, and then drifting along same eastward to come under workings below the main workings at Elev. 5052. This tunnel to start in the side of the gulch just above the mine road about midway between the 5052 and 4834 tunnels.

4a. ~~[illegible]~~ When the 4950 tunnel hits the Eureka vein ore drift from the 4834 tunnel eastward to come under same, and connect with a raise.

5. Driving a drift-tunnel on the Trudie vein at an elevation of 5052 to come under the present Trudie workings.

6. If the Alice Blue crosscut now being driven develops ore of satisfactory width and tenor, driving a crosscut tunnel northward to intersect it at Elevation 5034, portal of said tunnel to be approximately at shallow shaft at Elev 5008.

6_a. Drifting East and West on vein near portal of abovementioned crosscut tunnel. Navy Blue Vein (?).

All work to be done in the vein when practicable, with alternate working-faces (crosscuts or raises) to be provided as soon after the beginning of each face as possible to prevent loss of time of drill-crews. Drilling to be done from jumbos, mucking with

mucking-machines, tramming by animal- or storage-battery power.

While the above is in progress the following repairs and prospecting should be done:

I 1. Clean out cave in Alice Blue Tunnel and investigate showings below tunnel-level.

II 2. Clean out lower Jefferson Tunnel and consider advisability of drifting on the vein to the eastward.

III 3. Clean out drift to east of Eureka main tunnel, and investigate showings in the raise under the 80 foot shaft with an eye to putting the former for a connection. Extend drift to east after this raise is connected to surface, and consider crosscutting to north 300 feet to intersect Trudie vein and proposed Trudie drift-tunnel.

IV 4. Clean out drift to east of Eureka lower crosscut tunnel and consider advisability of drifting on this vein (Eureka or Trudie ?) eastward.

V 5. Trench on the surface to throw further light on the locations of the Navy Blue, Trenton, Jefferson, Georgia, Trudie, Eureka, and Marble veins in areas where no work has been done to throw light upon this matter.

Road-building should be done approximately in the following order:

A 1. Repair the road from the County Road to the portal of the proposed North Trenton tunnel and to the portal of the proposed Jefferson tunnel.

B 2. Consider the Eureka lower crosscut tunnel to be the probable main haulage level for the Eureka-Trudie-Marble area for the near future, and build a road from it to the Trenton mill-site area by as direct a route as practicable.

C 3. Repair or realign the road to Tubac, Carmen, or Patagonia, taking into consideration the Salero and Montezuma areas needs.

During the first six months of this work it is my suggestion that little/of a permanent nature be used. By using portable compressors until any individual opening begins to show values to justify more elaborate equipment machinery or equipment a much better overall cost will be shown. An exception to this would be the setting up of a good assay-office and testing-lab, preferably at Salero for use of the other operations in the future. Frequent assays should be made, and the dissimilar character of the ores from the different workings and at different horizons in the same workings will make milling operations complex. For this reason ~~early~~ testing should start practically concurrently with the blocking-out of ore.

A summary of the above-mentioned work shows a total of some 8000 feet of drifting and a possible 1000 feet of raising, plus one mile of road-repair and one-half mile of new road. The overall plan would call for the expenditure of the amounts shown below, and should be completed within a year's time on double-shift operation.

TOTAL COSTS

8,000 feet drifting.....	$200,000.
1,000 feet raising.....	25,000.
Roads	10,000.
Building repairs (Salero Camp)	15,000.
Assay office, testing laboratory, manned	10,000.
Supervision and Engineering	10,000.
Contingencies, 10%	30,000.
Total	$ 300,000.

I recommend the adoption of this plan for a preliminary development of the ground, acknowledging that it should be revised from time to time in light of the findings made, at all times giving the most-likely-looking/areas priority as to equipment, manpower, and effort that their relative standing at the moment indicates as being most promising for eventual profit.

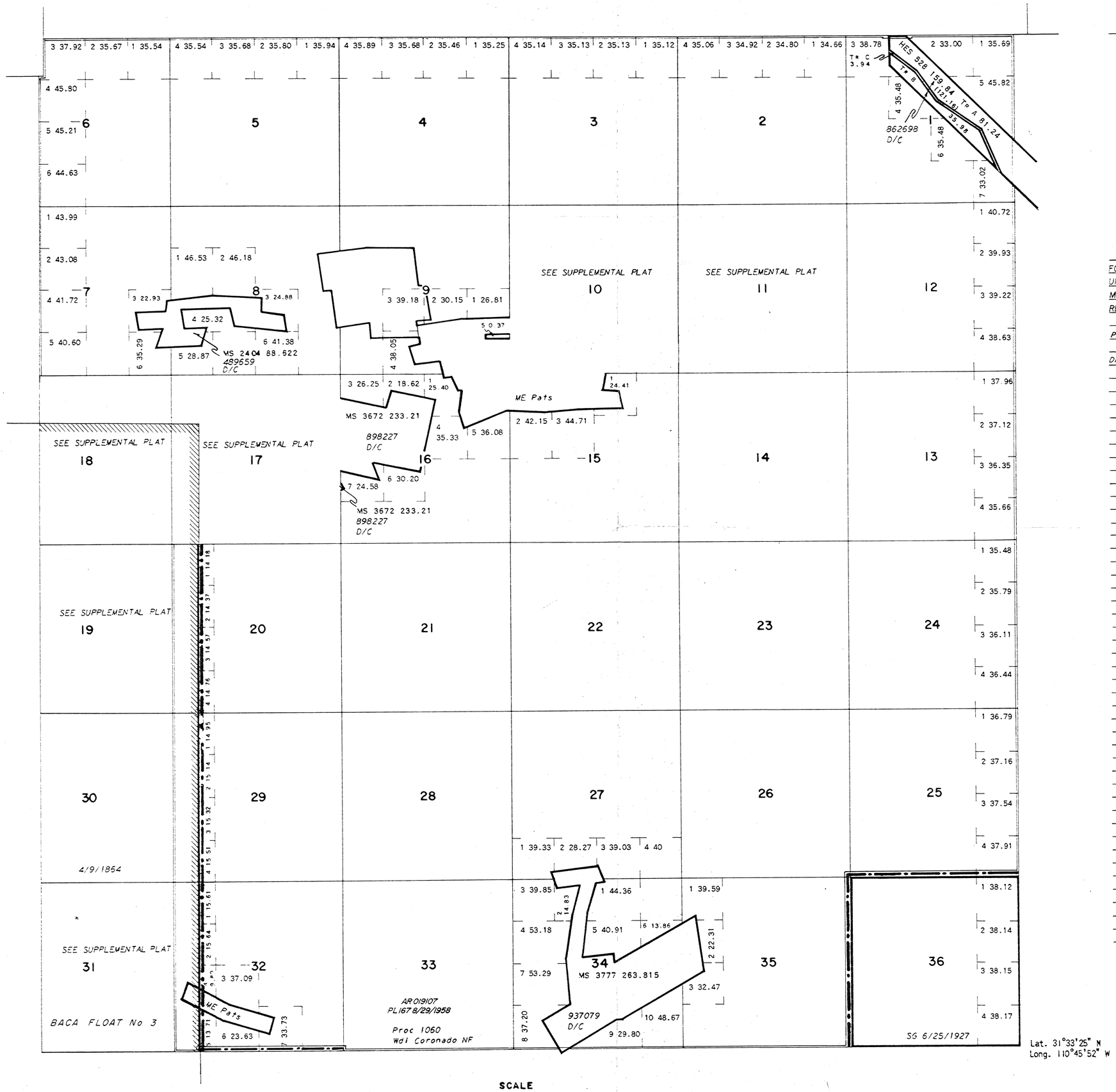
Respectfully submitted

Robert Lemon

PARTIALLY SURVEYED TOWNSHIP 21 SOUTH RANGE 15 EAST OF THE GILA AND SALT RIVER MERIDIAN, ARIZONA

STATUS OF PUBLIC DOMAIN
LAND AND MINERAL TITLES

SANTA CRUZ COUNTY



SCALE
10 5 0 10 20 30 60
30 chains to the inch

INDEX TO SEGREGATED TRACTS				
RESURVEY	ORIGINAL SURVEY			
TRACT NO	T	R	SEC	SUBDIVISION

FOR ORDERS EFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION, MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES, REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

PROTRACTION DIAGRAM NO. 76

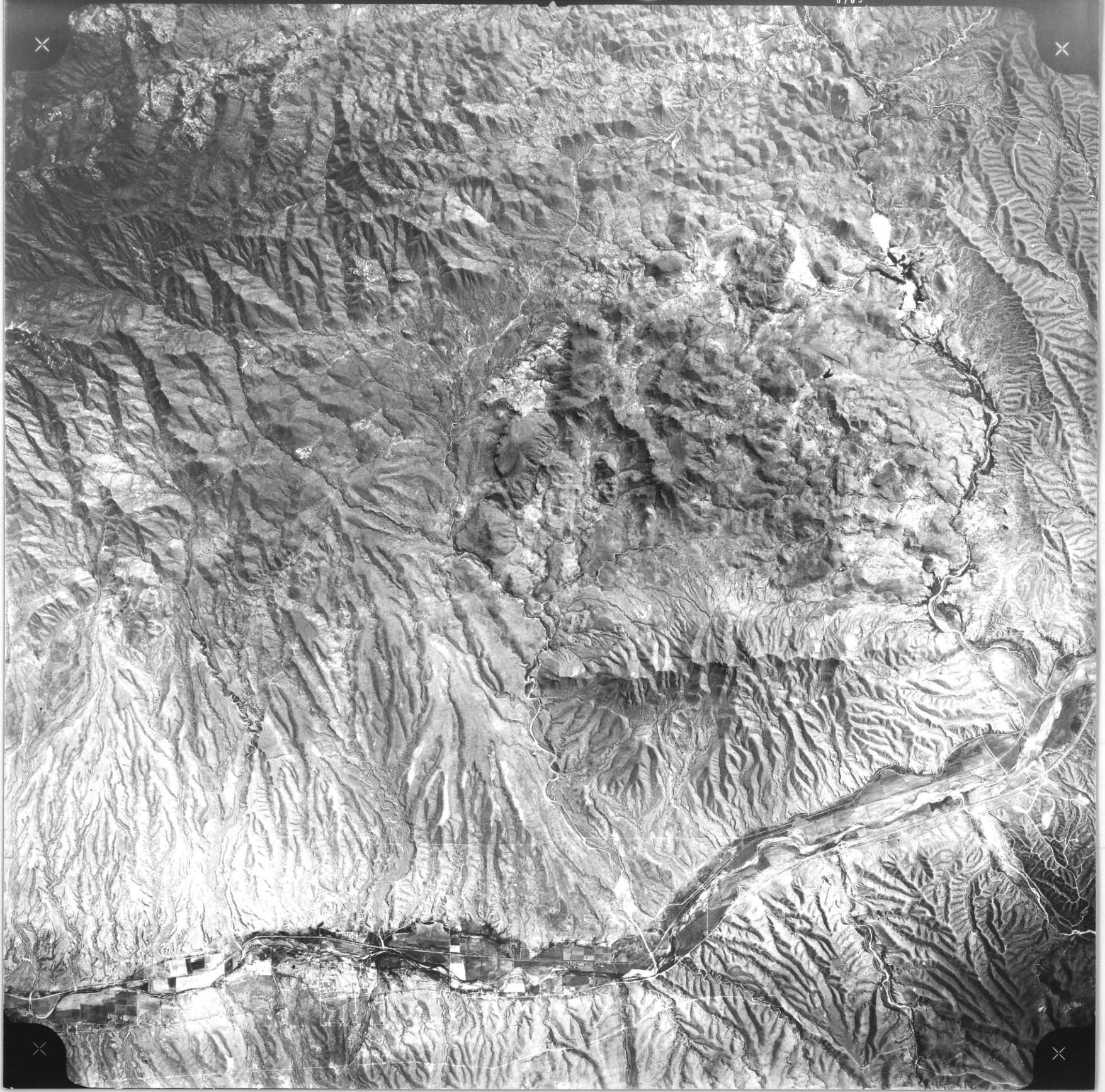
DIST. NO. 2

Lat. 31°33'25" N
Long. 110°45'52" W

CURRENT TO	BY

BUREAU OF LAND MANAGEMENT
PHOENIX, ARIZONA
1975 NOV 26 PM 3:44

T. 21 S.
R. 15 E.



COOPER AERIAL SURVEYS
1692 WEST GRANT ROAD
TUCSON, ARIZONA 85705
PHONE 884-7580

Nasa 1970

short truncated spurlike piedmont ridge about half a mile in diameter at the base and but a few hundred feet wide at the top.

History and production.—The deposit was discovered by the Jesuit priests of the Tumacacori mission about 1687, and they worked it pretty steadily up to 1857, when the whites were driven from the country by the Indians. About 1875 it was located as the Gold Tree by Mark Lully, of Nogales, who worked it for a few years and sold it about 1880. It was later worked occasionally, with moderate success, by Albert Steinfelt & Co., of Tucson, until about 1902, when it was purchased by the present owners, the Alto Consolidated Mines, Smelting & Transportation Co., financed by a Mr. Boynton, of New York. This company, operating in 1905 to 1907, inclusive, built roads, installed machinery, drove a long tunnel, sunk most of the shafts, including one 217 feet deep, and did most of the modern development work, principally on the Alto vein. Since 1907 some work has been done intermittently with a force of 5 to 10 men.

The property comprises a group of 21 claims, shown in figure 21. No definite statement of the early production can be made. The ores first taken out were very rich in silver, and no attention was paid to lead. In the late seventies, however, Mr. Lully shipped 12 tons of relatively pure lead-silver bullion. From February, 1906, to July, 1907, the production was $14,000, mostly in copper, lead, and silver, with a little gold. The ore was shipped[1] to the El Paso smelter and averaged about 5 per cent in copper, 32 per cent in lead, 9 per cent in zinc, and 24 ounces to the ton in silver. About 12,000 tons of low-grade ores said to range from 1 to 3 per cent in copper, 7 to 10 per cent in lead, and 4 to 6 ounces to the ton in silver lie on the dumps.

Development.—The mine is developed by tunnels, drifts, shafts, and stopes aggregating 10,000 feet or more of work. The openings are largely in the west slope and upper part of Alto Hill, most of the tunnels being spaced about 200 feet apart vertically. The longest tunnel is the Alto, which has a length of 1,632 feet. It is driven about 300 feet below the top of the hill and in alignment with a series of shafts sunk from the surface, with all of which it is designed to connect. The developments on the Alto vein alone, which constitute most of the modern work, aggregate about 6,000 feet, as follows: Shafts 1,050 feet, drifts 900 feet, tunnels 2,000 feet, stopes 2,000 feet. The company has spent several hundred thousand dollars, it is said, on the development and equipment of the property.

Geology.—The geology of Alto Hill is complicated. In the upper western part of the hill the country rock is mainly the quartz latite porphyry described on page 72, with probably a core or base of

[1] U. S. Geol. Survey Mineral Resources, 1907, pt. 1, p. 478, 1908.

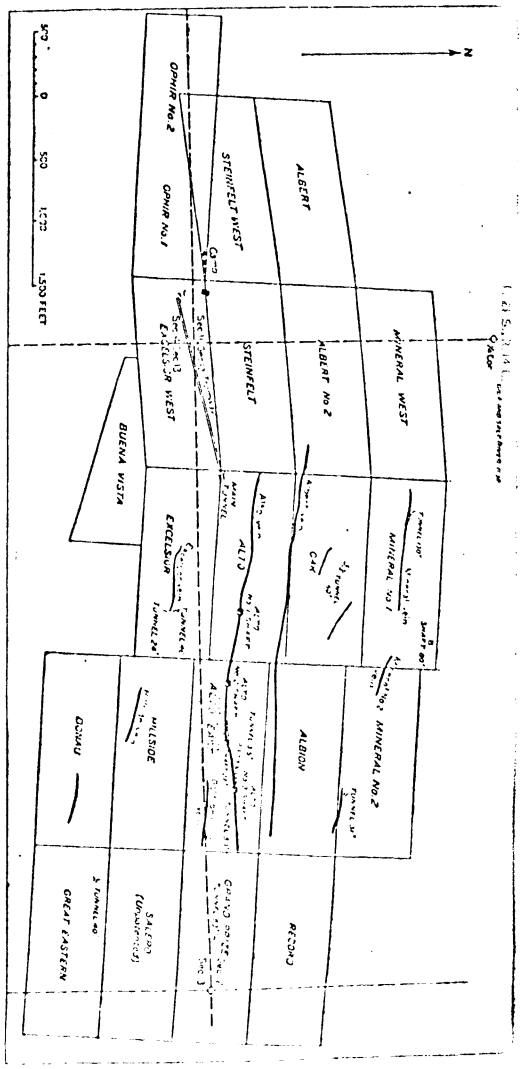


FIGURE 21.—Map showing claims and veins of Alto mine.

granite porphyry, which seems to be the dominant rock in the eastern part of the hill, and is soon succeeded by the belt of diorite and monzonite rising in the mountains on the east. The granite porphyry, and probably also the diorite, prior to the eruption of the latite apparently formed the east side of the valley or piedmont front on which the latite was deposited. Dacite and rhyolitic rocks and andesite are also present. The latite is disposed in massive sheets or flows, which at the top of the hill dip 35° E. and are agglomeratic. It seems to extend from the camp to the top of the hill and to be the principal rock in the mine, extending, with minor interruptions, from the mouth to the face of the Alto tunnel. Near station 8, about 1,200 feet in from the mouth of the tunnel, it gives way to granite porphyry, bowlders of which 2 feet or more in diameter occur as inclusions in the latite on the east near the top of the hill, toward shaft No. 1. At the face of station 6 drift, at 950 feet in from the mouth of the tunnel, the latite is intruded by dense dark reddish-brown andesite. Nearly all the shafts contain water and some are nearly filled.

Veins and ores.—The Alto property, as shown in figure 21, contains six veins, mainly in the latite and granite porphyry. They strike a little north of west and in general have a steep or vertical dip. Beginning on the north, they are the Mineral, Mineral No. 2, Albert, Alto, Excelsior, and Hillside.

The Alto vein lies in latite and granite porphyry and contains most of the development work which has been described. It extends through a length of two or more claims and is from 3 to 7 feet in width. It is opened by the 1,632-foot Alto or main tunnel with drifts, crosscuts, stopes, the Alto shafts, and also old workings. The tunnel, starting at the head of the tramway in the upper west slope of the hill, is driven eastward on or near the vein at about 300 feet below the top of the hill. The average dip of the vein for the first 300 feet in depth, as shown in shaft No. 1 (fig. 22), is about vertical, but the company now regards the steep dip to the north which prevails in the lower part of the shaft as the general dip of the vein.

At station 4, about 400 feet in from the portal of the tunnel, an auxiliary or blind vein dipping steeply to the north or vertical comes in from the west-southwest. It is opened by a back drift, known as the west drift, for 130 feet to the west and by stopes or upraises to the height of 20 or 30 feet. It shows a low-grade ore body 6 to 8 feet wide containing principally galena and a little copper, iron, silver, and zinc sulphides. It is said that some lead-silver ore and a little copper ore occur about all the way from the face of this west drift to the face of the tunnel.

For a considerable distance beyond the west drift the south wall of the tunnel is more siliceous and the country rock continues to be

latite, the same as at the portal, nearly to the 1,200-foot point, the formation is seemingly granite porphyry. Dense dark red brown andesite, probably a dike, occurs in the face and adj part of the 200-foot drift to the southeast from the 800-foot point. Andesite is also associated with the vein in shaft No. 1 from the surface down.

Between the 600 and 800 foot points appears another small vein dipping steeply to the north and containing low-grade chalcopyrite ore. Between the 1,400 and 1,560 foot points is a large body of kaolin or gouge, and here the vein is 6 feet wide. From the 800-foot point to the face of the tunnel, 1,632 feet from the portal, the vein is in general well defined and carries a more or less continuous 18-inch ore shoot in which the ore occurs in lenses and stringers of galena 6 inches or more in maximum width, and for the last 250 feet of the course the vein dips steeply to the south. At the mouth of the south drift which connects with shaft No. 1 the ore is all galena ore with very little silver and no copper.

In the face of the tunnel the vein is about 4 feet wide and contains an ore shoot nearly a foot wide in the north or hanging-wall side, the rest of the width consisting mostly of altered rock carrying sulphide ore minerals all the way across, with some concentration and copper leaching on the south or footwall side. The middle part of the vein in this portion of the mine is said to carry generally considerable sphalerite. There is here about 6 inches of argillaceous gouge on the footwall and a little on the hanging wall.

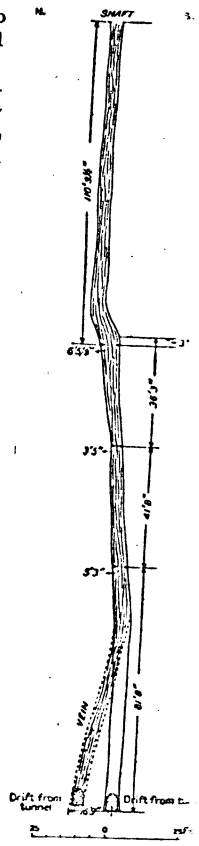


FIGURE 22.—Vertical section Alto vein in shaft No. 1.

On the surface the ore is more or less continuously exposed on the vein for a horizontal distance of about 2,000 feet from a point 100 feet west of No. 1 shaft to the east end tunnel, which is about 800 feet east of shaft No. and through about 1,200 feet of this distance, from a point west shaft No. 1 to a point east of shaft No. 3, the ore has a known vert

extent of about 300 feet. It is regarded by the company as an established fact that 800 feet of the 950 feet of this known ore body between shafts 1 and 3 contains 170 tons of ore for each foot and that the remaining 150 feet contains 100 tons to the foot, or a total of about 151,000 tons.

At shaft No. 1, which is 290 feet deep, the vein is 3 feet wide and stands about vertical. Small dikes of andesite show at the surface and are said to be associated with the vein in the shaft.

Farther east, in shaft No. 2, which is 140 feet deep and is sunk in granite porphyry, the vein dips steeply to the north and carries much sulphide. The ore is the same galena and silver bearing sulphide ore as that in the tunnel. Some stoping is done here on the 100-foot level.

Still farther east, between shaft No. 2 and the caved ground about 350 feet distant, the surface ore changes from lead-bearing to copper-bearing ore, and from the old 140-foot shaft, just beyond the caved ground, to No. 3 shaft, 400 feet distant, the vein averages 3 feet in width. The underground workings in this area are all connected but now contain water. From the beginning of the caved ground to shaft No. 3, about 600 feet distant, the ores are all copper bearing and show marked increase in the amount of iron sulphide. Here the best ores seen, some of which are rich, contain gray copper or tetrahedrite.

Shaft No. 3, 176 feet deep, is sunk on the vein in rock that seems to be granite porphyry and is in ore all the way down. At the surface occurs a small spur vein, and some brown intrusive andesite is said to be associated with the vein in the shaft.

West of the No. 3 shaft, toward and almost under the caved ground, the vein is about 12 feet wide and carries ore all the way across, but the best ore, which is of shipping grade, comes from the middle part of the vein, from a band 4 inches to 3 feet wide, not including many rich stringers in the remainder of the vein. The lateral portions of the vein contain about 1 to 2 feet of kaolinized gouge, and the walls are altered and decomposed at the surface. The vein filling is mostly siliceous matter, largely quartz containing pyrites and calcite.

At the old workings between shafts Nos. 2 and 3 the vein is about 7 feet wide and stands vertical. It is tripartite for at least 20 feet from the surface down and consists mainly of mineralized altered rock. Here and in an old work shaft near by to the east a very large amount of work has been done. The surface part of the vein is said to be stoped out for a distance of 700 feet, and much ore has been taken out, mostly by Mr. Lully. The very large dump is composed almost wholly of sulphide material, containing iron and copper pyrite and some galena.

The ore minerals of the Alto vein are galena, argentite, chalcopyrite, pyrite, tetrahedrite (gray copper), and chalcocite. The silver

is contained mainly in the argentite intimately associated wi galena and in the tetrahedrite. Where pyrite predominates vein the chalcopyrite is intimately associated with it and m the pyrite seems also to be cupriferous. Where the ore strongly or predominantly copper ore, tetrahedrite as well copyrite is usually present, and also some chalcocite and black copper oxide.

The Albert vein parallels the Alto vein about 300 feet to the as shown on the map (fig. 21). It has a known length of 3,000 feet and is well defined throughout. It is about 4 feet and dips steeply to the south. It is opened at several poi depths of 40 to 70 feet. The ore is similar to that of the Alto and averages about the same in tenor, but it is said to be in richer in chalcocite and black copper oxide and the surface are higher in silver. In case this vein and the Alto vein co downward and maintain their convergent dip they should me intersect at a depth of about 800 feet, where it seems reasonal expect considerable concentration in the deposits.

The Mineral vein, in the northern part of the Alto propert a known length of about 900 feet. It seems to lie chiefly in g porphyry and is opened by a 100-foot tunnel and several sh shafts, each about 40 feet deep. It is about 3 feet wide, dips s to the south, and consists of a lode of quartz stringers in a rock. Both the rock and the quartz contain ore, and much o been gouged out from the vein and a spur vein just to the east the gulch from the east workings. The ore is argentiferous ga with a little chalcopyrite and copper carbonates, and contains specular hematite, which in places forms a considerable part o gangue. Mineral vein No. 2 on the east is probably an extensio this vein or its fissure.

The Excelsior vein, which lies on the south side of the prop is known and well defined for nearly 1,000 feet. It is about 3 in width, and is opened by several shafts, short tunnels, and dr It is not of relatively great importance but contains workable reported to carry fair amounts of copper, gold, and silver, an little lead.

The Hillside vein probably occupies an easterly extension of Excelsior fissure.

WANDERING JEW MINE.

The Wandering Jew mine is located half a mile north of the A mine, in the upper north side of Apache Gulch, which separa Alto Hill from the mountains on the north, at an elevation of ab 5,500 feet. The camp is on the opposite side of the gulch, one-t of a mile to the southwest. The property comprises a gro

eight claims. It is developed to a depth of 100 feet by two shafts 300 feet apart, drifts, tunnels, and crosscuts aggregating about 2,000 feet of work, as shown in part in figure 23.

The country rock is gray diorite intruded by granite porphyry and latite. The property contains five or six veins or ledges, but the deposits are contained principally in the Wandering Jew vein, which has a reported length of about a mile. At the mine the vein varies from 6 inches to 4 feet in width and dips 50° N., into the mountains. The gangue is principally quartz. Between and adjoining the two principal shafts the vein is uncovered by a trench, and for a distance

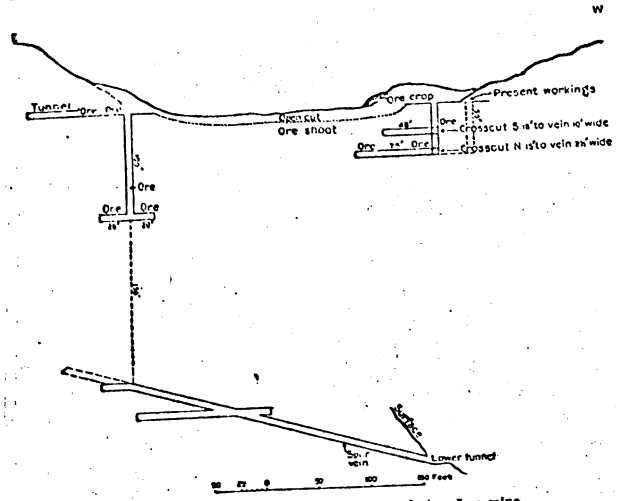


FIGURE 23.—Longitudinal section of Wandering Jew mine.

of about 400 feet it shows principally sulphide ore of the same character and grade as that found in the shafts, which are reported to contain ore all the way down and to be all in ore from the 40-foot level to the bottom.[1] From this statement the ore body, having a known horizontal extent of nearly 400 feet on the surface, seems to be a continuous sheet of argentiferous steel galena at least 100 feet in depth. Where the width of the ore body does not much exceed 1 foot the ore is said to be very pure. It is estimated that about half of the deposit is shipping ore, and the rest is good-grade concentrating ore. The ore is argentiferous lead ore and is essen-

[1] Blake, W. P., Report of the Governor of Arizona for 1903, p. 115.

tially sulphide or galena from the surface down, but in place contains a little copper carbonates and some chalcopyrite. T quartz croppings rise boldly 8 feet or more above the surface, toward the east the vein seems to be offset by a fault having a late throw of 60 feet.

The M. and S. claim, adjoining the Wandering Jew ground the southeast and opened by a 100-foot shaft, is said to contai large body of good-grade argentiferous zinc ore.

JOPLIN MINE.

The Joplin mine is three-fourths of a mile northeast of the mine and about the same distance southeast of the Wandering mine, at the head of Apache Gulch, on the south side, at an el tion of about 5,900 feet. It was owned by a Mr. Campbell al 1879, and in 1904 was bonded to Massachusetts people who shipped from it to the El Paso smelter 25 tons of ore that aver about 5 per cent each in lead and copper and 35 ounces to the in silver. About 30 tons of sulphide ore lies on the dump. property comprises three patented claims and is now owned the Joplin Mining Co., of Tucson. It is developed by about feet of work, including a 110-foot shaft, a 100-foot drift, a 220-foot crosscut tunnel.

The topography is mountainous. The mine is in the head small side gulch on the steep side of Apache Gulch. The co rock is fine-grained brownish-gray quartz diorite. The vein, sisting mainly of altered diorite and quartz, dips steeply to the and as seen in the drift seems to carry pretty continuously on the wall an ore shoot 3 inches to 1 foot wide and in a few places rep to be 2 feet wide, containing principally pyrite, chalcopyrite, a tiferous galena, and near the surface copper carbonates. The try rock, as shown by the crosscut tunnel extending 100 feet be the vein, is impregnated with disseminated sulphides and in contains also good ore.

At a depth of about 100 feet the vein, it is said,[1] encount nearly horizontal slip or fault, where with very flat dip it n an abrupt offset of 15 feet to the north, below which it resum nearly vertical downward course. The trend of the vein at ea of the offset is almost a right angle. At the offset the ore shoo but 3 inches in width, but the ore was rich, as it was also just the offset, where the ore shoot resumed its normal width.

APACHE MINE.

The Apache mine is located in Apache Gulch between the mine on the south and the Wandering Jew mine on the north.

[1] Bond, Josiah, Eng. and Min. Jour., vol. 92, p. 454, 1911.

deposit, which seems to be in diorite, was discovered about 1899. About 1900 the mine was purchased by the present owner, the Santa Rita Mining Co., of El Paso, Tex., which soon worked it extensively and in 1901 shipped to El Paso two carloads of black chalcocite ore that averaged, it is said, about $250 to the ton. About 90 tons of ore was concentrated by the Arizona Gold-Copper Co. near by.

The property comprises a group of six claims, all of which are patented. It is said to be developed to a depth of 470 feet by tunnels, shafts, and crosscuts aggregating more than 2,500 feet of work. The company is reported to have expended more than $5,000 on the property.

THREE STAR PROSPECT.

The Three Star prospect is a quarter of a mile northwest of the Wandering Jew mine, on the north side of Apache Gulch, at an elevation of 4,770 feet. It is on a quartz vein which dips 85° S., in latite, and is opened by a shaft and three 10-foot holes. The quartz contains a little chalcopyrite and galena coated with earthy cerusite, argentite, and malachite.

TOLUACHI GROUP.

The Toluachi group, owned by Josiah Bond, whose camp is 1¼ miles north of Alto, comprises 19 claims lying north and east of the camp. The country rock is a somewhat tuffaceous latite of dark-green color. Along its eastern border, however, the formation contains so much granite porphyry, apparently in the form of included bowlders and pebbles, that it has been mapped as granite porphyry. The rock is cut by a large number of small fissures which trend about east, the principal strike being N. 85° W. As many as 50 small veins were noted in a distance of three-fourths of a mile north from Bond's cabin. The quartz veins are mostly rather small but range up to 4 feet in width. They are stained with iron and manganese and in places show copper carbonates at the surface. Some of the claims are said to be bonded to eastern people. Among the principal prospects are the Jersey Girl, Silver Sally, and Merry Widow.

The Jersey Girl prospect is located just east of Bond's cabin on a 5-foot lode which at the surface dips 80° S., in latite breccia, and occupies a well-defined fissure 4 to 6 feet wide, filled mostly with gouge and crushed rock. Toward its middle, however, as shown in figure 24, it contains two small veins or pay streaks from 2 to 6 inches in width, composed principally of a quartz-calcite-siderite gangue with a little rhodochrosite and rhodonite. The filling of the lode in general, not including the two quartz veins or pay streaks, is said to average $20 to the ton in copper and silver. One of the

veins or pay streaks is composed chiefly of copper and lead stained quartz showing galena and seemingly a little gray copper. Some of it is banded, but postmineral movement has crushed it. The principal ore minerals are galena, proustite, tetrahedrite, horn silver, embolite, bromyrite, chalcopyrite, chalcocite, malachite, azurite, cuprite, argentite, and tennantite.

The richest ore is said to occur on the 80-foot level, where the two pay streaks join or intersect. Some of it carries 10 per cent in copper, 30 per cent in lead, and 120 ounces to the ton in silver. On the north wall the ore contains much white mica. Between the two pay streaks sericitic mica still remains, but the filling is mostly quartz, and it is stained with manganese and iron. On the 90-foot level chlorite is associated with the sericite. On the south wall, where also the material is much iron stained, it apparently runs higher in silver.

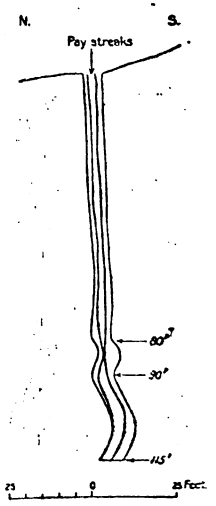


FIGURE 24.—Cross section of Jersey Girl shaft and veins.

The Silver Sally prospect is on a vein which strikes N. 60° W. and is opened by a 280-foot shaft and a 100-foot drift to the east on the 220-foot level. The vein is 15 feet or more in width. It consists principally of iron-stained silicified diorite, which, however, contains a 4-foot band of iron and lead stained quartz that carries galena and sphalerite. Some of the ore, which probably contained horn silver or cerargyrite, is said to have averaged 50 ounces in silver to the ton.

The Merry Widow prospect is located in Bond Canyon at an elevation of 4,970 feet, on the Merry Widow-Badger vein, which dips steeply to the south in andesite breccia and is opened by a 100-foot shaft, from the bottom of which a 45-foot drift has been run to the west, with a 20-foot winze sunk at the face. The vein contains ore, of which a shipment of 5 tons is said to have averaged 8 per cent of lead and 72 ounces to the ton in silver. The ore also contains some copper and zinc, and for the latter mineral the shipment was penalized. The ore minerals are principally galena, sphalerite, and chalcopyrite, contained in a quartz-calcite gangue.

ARIZONA-PITTSBURG MINE.

The Arizona-Pittsburg mine is located 3½ miles north of Salero and about a mile northeast of the Jersey Girl prospect, on the south

fork of Bond Canyon, at an elevation of 5,550 feet. The vein on which it is located has been known for many years and is said to have been worked in the nineties. In 1905 J. M. Orosco relocated the property and sold it to Frank Reichert, who called the two principal claims the Black Hills Nos. 1 and 2. In 1908 the present owners, the Arizona-Pittsburg Mining & Smelting Co., of Pittsburgh, Pa., bought the property.

The property comprises a group of five claims. It is developed by a 185-foot shaft and 25 feet of drift to the west on the 125-foot level.

The topography is rough (Pl. I, in pocket). The country rock is diorite, and the deposits are contained in a 9-foot quartz vein which dips 87° N. This vein extends a mile or more to the east and is thought to be the vein on which the Augusta or Hosey and American Boy mines are located, respectively about 1 mile and 2 miles to the east, on the opposite side of the divide in the Wrightson district.

The quartz in general is stained with iron and manganese and a little azurite and malachite. The ore minerals it contains are galenite, pyrite, and chalcopyrite. Some galenite occurs in the surface ore, but sulphides are not abundant above the 70-foot level. From that level down, to judge from the material seen on the dump, the ore consists largely of galenite in a silicified brecciated diorite gangue, and there is a marked increase in pyrite and chalcopyrite in the lower part of the mine, where the ore seems to contain also some tetrahedrite.

ROYAL BLUE MINE.

The Royal Blue mine is located just west of the United States location monument No. 11, which is between the Alto and Bland camps. It is owned by the Apache Mining Co., of Cincinnati, Ohio, and is said to be developed by a 60-foot drift tunnel and a 40-foot shaft sunk from this level, which is 16 to 18 feet below the surface. There are also two lower openings, one a crosscut and the other a drift. The mine is on a vein which is supposed to be an offshoot from the Bland vein and which carries copper and silver, principally in chalcopyrite and galena. A streak of good ore of shipping grade, it is said, is now being worked in it by Thomas Frazer, of Tucson, and a tunnel is being driven to undercut the shaft.

TRENTON MINE.

The Trenton mine is a quarter of a mile south of the Alto mine, in the bottom of Trenton Gulch, at an elevation of about 4,800 feet. It is on a vertical or steeply southward-dipping vein in granite

porphyry, but the footwall in the lower part of the mine is repo to be diorite.

The mine was first worked in 1891 by Clark & Peterson, f whom it was purchased in 1901 by the Arizona Copper Co., w sunk the main shaft and built a mill at a point 1 mile to the The Trenton Mining Co., with headquarters in New York, acq the property in 1906, and recently Frank Reichert became the o There is a small mill which is not in good repair.

The mine is opened by a 120-foot shaft containing about 80 of drift on the 50-foot level, 230 feet on the 80-foot level, an feet on the 110-foot level. The vein is said to be the northwes extension of the Old Jefferson vein. It is 12 feet in width and sists largely of a stockwork in brecciated diorite with a qu barite gangue. The ore is lead-silver and is contained in s about 8 inches in width, which extend along the vein, and to the east. The principal mineral is argentiferous galena.

It is said that in 1904, from one ore shoot in the lower east were shipped 150 tons of ore which averaged 58 per cent in lea ounces to the ton in silver, and a little copper. Zinc is said to in a streak of barite near the footwall.

JEFFERSON TUNNEL.

The Jefferson tunnel is located on the south side of Trenton southeast of United States location monument No. 11, at an tion of 4,985 feet. The property is owned by Curtis & Steinf Tucson. The tunnel runs S. 40° E. for 110 feet but could examined for more than 75 feet from the mouth on accou water. The country rock is diorite. It is said that at 90 fee the mouth the tunnel cuts a siliceous vein carrying ore that co principally chalcopyrite and galena. Apparently the same le cut in a tunnel about half a mile to the east on the Georgia

BLAND MINE.

The Bland mine is located in Alto Gulch about a mile southe the Alto mine, at an elevation of about 5,400 feet. It was disc in 1885 and worked until 1889. The mine is now owned by W Powers, R. Crew, T. M. Heck, and F. Reichert, who report tha have sold from it $1,200 worth of ore and that the total prod from the mine up to 1909 was about $4,000. Two carloads taken out near the divide and sold to the El Paso smelter are said to have averaged 64 per cent in lead, 24 per cent in and 35 ounces to the ton in silver. Recently it was reported t driving 535 feet of drift good concentrating ore was taken o a distance of 200 feet.

The property comprises a group of five claims extending eastward into Squaw Gulch. As indicated in figure 25, it is developed by a tunnel and drift aggregating about 1,500 feet of work.

The deposits are principally contained in a main vein which occupies a fault fissure in diorite and stands about vertical or dips steeply to the north. The vein is opened at numerous points over a horizontal distance of about half a mile and a vertical distance of 540 feet. It is supposed to extend westward to the Alto ground. It is from 3 to 6 feet wide and consists principally of gouge and crushed diorite in which the ore minerals chalcopyrite and pyrite are generally disseminated. The better-grade ore consists largely of

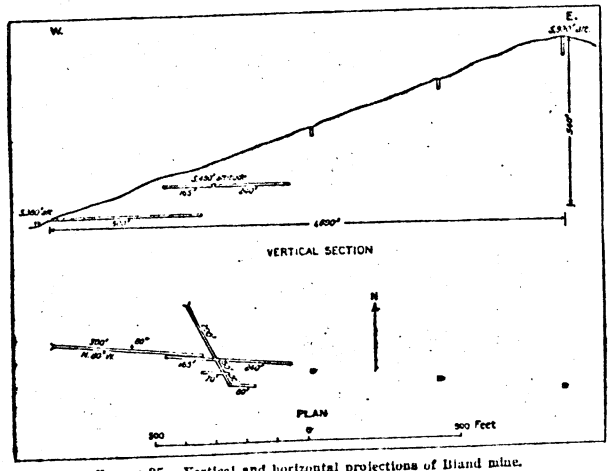


FIGURE 25.—Vertical and horizontal projections of Bland mine.

lenses of almost pure massive chalcopyrite which pitch to the east. Separating the ore-bearing portion of the vein from the wall rock on each side is a sheet of later gouge. The wall rock, however, for 5 or 6 feet from the vein is impregnated with disseminated pyrite and chalcopyrite. The slickensided walls indicate greater lateral than vertical movement. Along the footwall in the lower tunnel is a small seam of banded quartz and sulphides which widens out into two fair-sized lenses of ore in the 500 feet of drifting. One of these lenses or ore shoots starts at a point about 25 feet in from the mouth of the tunnel and extends for 100 feet toward the face. It varies from 2 to 4 feet in width and contains massive pyrite and

also seen on some of the joints. Ore of this class is said to ru
25 per cent in copper and 50 ounces in silver and $4 in gold to
ton. The last 100 feet of the drift is in the second lens, which
the entire fissure, 4 feet wide. This lens is composed of mas
pyrite and chalcopyrite crudely banded with quartz and is said
run 16 per cent in copper and 8 ounces in silver and $2.80 in
to the ton. There is about 300 tons of ore on the dump of
tunnel which is reported to assay 8 to 12 per cent in copper
6 to 15 ounces in silver and $3 to $12 in gold to the ton.

The vein is opened at 100 feet above the lower tunnel by a cr
cut tunnel with a 165-foot drift to the west and a 240-foot drif
the east. It is said that in the west drift, which is near the surf
the vein is 3 feet wide and contains a larger proportion of lead t
in the east drift, where the backs are much heavier and the ve
9 feet wide and carries from 2 to 4 feet of siliceous copper
phide ore.

A parallel vein along which a 70-foot drift has been run, 50
south of the Bland vein, is said to show 3½ feet of galena-chalco
rite ore. On a second parallel vein 100 feet south of the Blan
an 80-foot drift to the east. It is reported that this drift show
feet of massive pyrite and chalcopyrite ore, which runs 10 per
in copper with considerable silver and a little gold. There is a
500 tons of ore on the dump, which is said to average 6 per cen
copper, 13 per cent in lead, and $2 in gold and 17½ ounces in silve
the ton.

In the 60-foot shaft on the divide at an elevation of 5,930 feet
ore is largely galena with a very little pyrite and chalcopyrite
tained in a quartz gangue. It is stained with limonite, azurite,
malachite and is reported to average about 40 per cent in lead,
cent in copper, and 23 ounces to the ton in silver. It is said tha
the ore here was argentiferous galena to a depth of 60 feet, wi
copper sulphides began to appear, a feature which seems to be
eral in this property.

EUREKA MINE.

About a mile north of Salero, extending from a point east of
township line along the south line of sec. 12 in the northeast
of Salero Hill and adjoining ground, are several mines which
been productive, among them the Eureka, Thunderer, and High
Some of them are reported to have been prospected by Humbol
very early days. The topography is mountainous. The depo
are contained principally in a 5-foot east-west, about vertical, qu
vein in fine-grained iron-gray quartz diorite.

The Eureka, better known as the Old Mexican mine, was
worked in 1870 or before. After the Civil War it was re

and late in the eighties it was acquired by a New York company and considerable high-grade copper-silver ore was mined. About 1898 it passed into the hands of Clark & Peterson, from whom in 1902 it was purchased by the present owner, C. H. Ferry, of New York, who already owned the Marble and Thunderer, adjoining patented claims, and at the time of visit was patenting the remainder of the group of six claims. Mr. Ferry soon did nearly 2,000 feet of work, mostly in tunnels and shafts on the Eureka and Marble claims and in crosscuts on the Highside, and from the Eureka he took out and shipped considerable ore.

The general run of mine ore, of which several hundred tons now lie on the dump, averages, it is said, about 18 per cent in lead, 2 per cent in copper, and 40 ounces to the ton in silver, but some rich bodies or pockets show about 2,000 ounces in silver to the ton. A shipment of four carloads of the hand-sorted ore in 1901 is said to have averaged more than 100 ounces in silver to the ton. The ore minerals are principally argentite, tetrahedrite, galena, and chalcopyrite. Other metalliferous minerals are chrysocolla, azurite, malachite, covellite (?), a little specularite, and sphalerite. Much of the quartz gangue is greenish, crushed, and recemented by seams of iron oxide and silica.

MONTEZUMA MINE.

The Montezuma mine is 1¼ miles south of Salero, on the Salero-Patagonia road and the township line at the northeast base of the Grosvenor Hills, at an elevation of about 4,350 feet. It was worked in the early part of the nineteenth century by the Jesuit priests and in 1857 and 1858 by the Wrightson brothers, who worked only surface ore in an 8-inch vein.

About 1860 it was worked by the Aztec Mining Syndicate, which is said to have sunk a shaft to a depth of about 300 feet. In the upper levels the vein, for the most part, did not much exceed a few inches in width and did not pay to work, but at the bottom of the shaft the vein gradually widened to 34 inches and contained reticulating lenses of silver and copper glance ore, some of which averaged $2,250 or more to the ton, the copper content being about 15 per cent. But the ore was not sufficient in quantity or high enough in grade to be workable at that time, although about 15 tons of it was shipped.

Later in the sixties the mine was acquired by the McCormick Harvester Co., of New York, and was examined for that company by J. H. Hammond, who made an unfavorable report. About 1900 it was leased by Clark & Peterson, who took out about 30 tons of silver and copper glance ore. This ore, after hand sorting, averaged about 125 ounces in silver to the ton, no allowance being made for

The mine is developed to a depth of only 80 feet, principa shallow shafts and drifts. The property as commonly know prises three claims, the Montezuma and the east and west sion claims, known, respectively, as the Empress of India a Queen of Sheba. The Montezuma claim, which contains the and the west extension are now owned by the Red Cloud M Co., and the east extension is owned by C. H. Ferry, who i to have made in recent years a thorough test of his claim by p down six diamond-drill holes to a depth of 300 feet, finding the continue at this depth with about the same characteristics as n surface. The ore minerals occurred in stringers varying from that were very thin to those about 8 inches in width, but they no indications of workable deposits.

The mine is on open, hilly ground. The country rock is m grained iron-gray quartz-bearing diorite. The deposits ar tained in a silicified and partly sheared and crushed zone or l this rock and associated quartz, which dips 65° N. The lode vicinity of the mine is 175 feet in width. It is plainly tracea nearly a mile east of the mine and is said to extend very mu ther. On the west it passes beneath the covering of the young canic rocks.

The lode contains also considerable quartz and iron or ferru material in rough-surfaced irregular stringers, veins, and ranging from half an inch to nearly 18 inches in width and lying about parallel with the dip or main structure of the Also in the wall rock for 10 feet or more back from the lode veloped a stockwork of reticulated quartz veins or stringers. of which lie at about right angles to the lode.

The croppings, which are mostly prominent, are heavily with iron and manganese and in places with copper carbona oxidized minerals of silver. A distinctive feature of the ledg 8-foot vein of quartz or siliceous ore on the north or hangin side, containing considerable chalcocite or copper glance.

The deposits occur in numerous quartz stringers from 1 inc inches in width, which carry malachite, azurite, chrysocolla, li cuprite, and seemingly argentite. The work on the claim irregular; it follows the small mineralized stringers in a chl manner. Most of the work, comprising four shafts, is on a stringer about 40 feet north of the south edge of the silicen The eastern shaft is 30 feet deep and connects with another 5 the west by a drift 10 feet below the collar. This shaft is abou 80 feet deep, and in it a 30-foot level extends to the west. At 4 west of this shaft there is a 20-foot shaft, and the westernmo is 40 feet deep.

VULCAN MINE.

The Vulcan mine is 3½ miles north of Wise's ranch, 5 miles north-northwest of Salero, and a mile west of Josephine Canyon, in the foothills. It is on a prominent 10-foot silicified iron-bearing or ferruginous ledge, in intrusive diorite or andesite "porphyry," on or near its contact with the Paleozoic limestone, which dips to the south-southwest. The deposit contains, besides iron, some chalcopyrite and copper carbonates.

SQUAW GULCH AREA.

The principal mines in the Squaw Gulch area, in the eastern border of the district, some of which have been productive, are the Burro, Viceroy, Victor, Rosario group, and Ivanhoe.

BURRO MINE.

The Burro mine is located in the upper part of Squaw Gulch, half a mile east of the Bland mine, at an elevation of about 5,740 feet. It is on two heavily iron-stained quartz veins where they cross the contact of granite porphyry intruded into the country-rock diorite. The veins strike about N. 75° W., and the formational contact approximately follows Squaw Gulch in a north-south direction. The veins are opened by shallow shafts, which are filled with water, but the dumps show fair-looking ore consisting mainly of galena, pyrite, chalcopyrite, and a little chalcocite, contained in a quartz gangue.

VICEROY MINE.

The Viceroy mine is three-fourths of a mile southeast of the Burro mine, at an elevation of about 5,455 feet, on the east slope about 500 feet above the gulch. It is opened by a tunnel, which is somewhat caved, but is said to be 300 feet long and to connect with a 70-foot shaft near the face. The tunnel follows a vertical fissure trending N. 75° W. in granite porphyry. Owing to timbering but little of the vein is exposed in its first 150 feet. Water from the vein is depositing alum. On the dump is a few tons of quartz ore carrying principally chalcopyrite, galena, malachite, and some chalcocite.

The vein is traceable westward into Squaw Gulch, where it cuts through diorite, crossing the bed of the gulch on the 5,550-foot contour, and it apparently continues westward as the main Bland vein.

VICTOR MINE.

The Victor mine is a quarter of a mile southeast of the Viceroy mine, in an east fork of Squaw Gulch, at an elevation of 5,550 feet. It was located about 1895. The present owners, Bacon & Koon, of

The mine is opened by a 330-foot tunnel, a 90-foot upraise, a 80-foot drift (fig. 26). The country rock is granite porphyry; it is cut by a system of east-west faults. Some of the fault fissures contain mineral-bearing quartz veins, in one of which most of the deposits occur. This vein, which is followed by the tunnel in an irregular easterly course, is 4 to 6 inches wide and is contained between good walls with gouge on either side. At 200 feet in from the mouth of the tunnel occurs an ore shoot which the upraise follows to the surface. At 130 feet beyond the upraise, where the vein is cut obliquely by a N. 70° E. fault, is a second ore shoot that pitches to the west and has a width of 15 feet on the strike of the vein. In the 80-foot drift extending eastward on the fault shows about 6 inches of quartz, carrying some mineral. The ore contains principally galena and chalcopyrite in a quartz gangue.

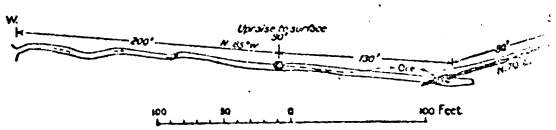


FIGURE 26.—Plan of Victor tunnel.

ROSARIO GROUP.

The Rosario group, which has produced some ore,[1] is located about 1½ miles northeast of Salero, on the divide between Josephine Canyon and Squaw Gulch, at an elevation of about 5,100 feet. The property comprises nine claims. They were located in 1904, but the work on the Rosario No. 1 claim is very old, probably Mexican.

The deposits are contained in several quartz fissure veins in altered diorite. The veins mostly strike west-northwest and are linked, forming a stockwork. They are opened by tunnels and shallow shafts aggregating several hundred feet of work. The vein followed by the 150-foot tunnel and 60-foot upraise near the camp, on the Rosario claim, carries a stringer of quartzose ore containing principally a little earthy cerusite and galena, which is said to average very high in silver. Just north of this vein and the camp is a larger and more distinct vein which throughout seems to be a stockwork of quartz veinlets in altered diorite, carrying limonite, psilomelane, cerusite, and galena.

The vein on the Rosario No. 2 claim dips steeply to the south and stands vertical. It ranges from 8 inches to 2 feet in width, and in some places has good walls. The filling is apparently breccia

diorite and quartz, the whole being very much stained with iron and manganese oxides and lead carbonate. It shows a little galena coated with earthy carbonate and is said to carry horn silver, silver bromide (bromyrite), and native silver. The ore is reported to average about $25 to the ton, mostly in silver with minor amounts of copper. The vein is opened by two shafts and cut. The main shaft is 110 feet deep, with a 20-foot drift to the east on the 70-foot level and two drifts on the 100-foot level. The shaft to the northwest of the main shaft is 25 feet deep and is said to have been sunk on a pocket from which were taken 3 tons of silver ore that netted $240 to the ton and contained about 3 per cent in copper. Though some galena is mixed with the oxidized ore found at a depth of 110 feet in the main shaft, the sulphide zone has not been reached.

Two parallel veins on the United States No. 2 claim are about 90 feet apart and dip steeply to the south. The northern vein, opened by an 80-foot shaft that is half filled with water, contains principally lead ore, which averages about 40 per cent in lead and from 3 to 4 ounces to the ton in silver. The minerals observed are galena and sphalerite contained in a gangue of white quartz and altered crushed diorite. The southern vein is about 2 feet in width. Its value lies principally in copper and silver.

IVANHOE MINE.

The Ivanhoe mine is 3 miles northwest of Patagonia and 3 miles east of the Montezuma mine, on the east side of an eastern tributary of Squaw Gulch, in the upper part of the ridge which separates this gulch from Smith Gulch, an adjoining tributary to Temporal Gulch on the east. It is at an elevation of about 4,600 feet and is reached by wagon road. Some of the openings are on the Smith Gulch side of the ridge, where they descend to the 4,300-foot contour.

To judge from an old 300-foot cut thought to have been made by the pioneer Mexicans, mineral deposits were probably discovered here early in the fifties, but modern activities date from the rediscovery and location of the ground in 1905. A year later the mine was acquired by the present owner, the Ivanhoe Mining Co., of Minneapolis, Minn.[1]

The property comprises a group of 22 claims. At the time of visit it had produced and shipped some ore,[2] amounting, it is said, to $700 more than the cost of development work and expenses. About 1,700 tons of fair-grade milling ore lay on the dump. The property has since been steadily developing and producing on a moderate scale. Toward the close of 1911 it was reported that ore shipments

[1] U. S. Geol. Survey Mineral Resources, 1906, p. 179, 1907.
[2] Idem, 1907, pt. 1, p. 178, 1908.

netting over $10,000 had been made and that several th of ore was in sight in the mine and on the dumps. At the the mine was developed by about 300 feet each of tunne shafts to a depth of about 250 feet, which with subsequ ment probably aggregates about 2,000 feet of modern company had then planned to sink to the depth of 400 f

The topography is mountainous but not rugged. T rock is red granite, locally called "quartz porphyry" strong contrast of its greasy-lustered quartz with the re Some of the feldspars are altered to the pale-greenish kaolinized and sericitized stage. The rock is a medi granitic rock composed almost wholly of orthoclase a Some of the orthoclase is microperthitic. Biotite or seems to have been present in small amount, but in the ined is altered beyond determination. In the vicinity o the granite is considerably leached.

On the east the granite is overlain by gray andesite, whi the slope to a point about 150 feet above Smith Gulch an mercial tunnel, and in the tunnel at this place diorite intermediate in age between the granite and the ande present. A portion of the ridge is capped by reddish, p fied andesite tuff or "burnt rock," which near by and i seems to be intrusive into the granite and is said to contai fair amounts of silver. Both the granite and the andesite by a north-northwest sheeting with steep easterly dip.

The mine seems to be in part on the easterly extensi Montezuma vein, which here dips 80° SE. and with a vert of 600 feet trends across the ridge into the head of Smith at an elevation of about 4,300 feet is opened by the 200-foot cial tunnel or drift. The drift is mainly in andesite, but greenish diorite forms the hanging wall of the drift and the south. The vein as shown in this drift is about 4½ feet consists mainly of irregularly, coarsely, and crudely bande ish iron-stained and whitish silicified and kaolinized al mineralized rock breccia and quartz. It is more or less honeycombed, and in places, particularly in the face of which is in ore at about 200 feet below the surface, it conta pockets or bodies of galena, some cerusite, and a little lea date. Associated with the ore minerals are also some ep manganese and iron oxides. In this drift sulphides first ap point about 100 feet from the portal and 100 feet below the About 150 tons of concentrating ore piled on the dump i average about $3 in gold and $6 in silver and lead to the t

To the southwest up the slope, about 400 feet above t tunnel, at the Commercial No. 1 shaft, which is but litt

a 10-foot incline, the vein or ledge, which here lies in the granite, is about 40 feet in width and has yielded some ore said to average 90 ounces in silver and $6.50 in gold to the ton.

On the westerly slope of the ridge to the south of the Montezuma vein occur two veins or lodes which trend in a northerly direction, about parallel with the ridge and the sheeting structure in the rock, and obliquely to the transverse Montezuma vein. The western vein is known as the sulphide vein and the eastern one as the horn silver vein. The sulphide vein, as shown in the bottom of the 100-foot vertical shaft and its crosscut to the east, is about 10 feet in width and has fairly good footwalls, and the mineralized zone containing it is about 28 feet wide. It is a blind vein, without croppings other than a little brecciated granite. It was first encountered in the shaft about 50 feet below the surface, where the entire shaft for some distance is in ore. In the upraise from the south drift at the bottom of the shaft the vein contains a 4-foot ore shoot, which consists mainly of crushed granite intruded by dark andesite, all more or less ferruginated and silicified, in part carries chalcopyrite and argentite, and is said to average 12 per cent in copper and 140 ounces in silver and $2 in gold to the ton. In the north drift from the bottom of the shaft or adjoining part of the crosscut a 16-inch ore shoot on the east or hanging-wall side of the vein, which is banded, is richer than the corresponding part of the vein in the south drift. It contains considerable chalcocite and is said to average about 21 per cent in copper and 300 ounces in silver and $9 in gold to the ton. Much of this ore readily air slacks on exposure.

The horn silver vein lies about 100 feet east of the sulphide vein, in altered granite, and is seemingly associated with an andesite dike. It is opened by a 90-foot crosscut tunnel connecting with a 120-foot inclined winze, with about 150 feet of drift on the tunnel level and as much more at the bottom of the winze. It is several feet in width and at about 140 feet below the surface changes from a steep westerly dip to a steep easterly dip. It is composed mainly of crudely banded silicified iron and manganese stained crushed rock and quartz. The ore occurs in stringers or streaks from 1 inch to several inches in width and carries good values. It contains mainly silver chloride, or horn silver, and silver chlorobromide, or embolite.

The dumps at the western shafts and tunnels contain about 1,500 tons of ore, said to average 1½ per cent in copper and 17 ounces to the ton in silver.

ELLEN DELLA AND VANSUELLA PROSPECTS.

East of the Ivanhoe mine, on the Smith Gulch side of the ridge, are several prospects, of which the Vansuella, on Smith Gulch,

Republican vein, as is probably also the Ellen Della, near by the Vansuella prospect the vein is associated with the contact younger dark andesite intruded into the older andesite and see also into the diorite, and the ore is similar to that of the Com tunnel, on the Ivanhoe, described on pages 216–218.

The Ellen Della prospect, owned by James Cochran, of Br Pa., is located at a point intermediate between the Vansuella a Ivanhoe, about 50 feet above the gulch, at an elevation of 4,4 Here the vein is in coarse granite, strikes N. 55° E., and is stained with hematite and malachite. It is opened by a shaft.

BRADFORD MINE.

The Bradford mine is located in the southern border of th dall district, 5 miles southwest of Patagonia, at an elevation o 4,000 feet, in a side gulch of Sonoita Creek, from which it is one-third of a mile distant. Bloxton, the nearest railroad sta 1 mile to the east.

The mine is now owned by C. H. Ferry, of New York deposit was discovered in the late seventies and has been w intervals, at first for gold and later for copper. It is repor recently the Copper Queen Co., of Bisbee, has taken over t and will develop it on a large scale.

The property comprises a group of five patented claims developed to a depth of about 200 feet, mainly by shafts an aggregating about 1,000 feet of work distributed on three le mainly on the 60 and 120 foot levels.

The mine is in hilly ground, but it is reached by a wagon fair grade and more directly by trail. The country rock grained diorite, and at the mine the diorite is seemingly cu east-west agglomeratic rhyolite dike or possibly is in conta a sunken fault block of this rock about 240 feet in width deposits are associated with the contact. The dike contains sions of the diorite and is traversed by a north-south sheetin the east the rhyolite overlies the diorite and covers Sanfor where it is rather thick. Along the subordinate divide ab feet north of the mine it is highly silicified and replaced by which is heavily iron stained, resembling vein croppings.

The deposits are contained in the dike, which near its mi traversed longitudinally by silicified parallel croppings, a openings follow the gulch across it from north to south, th shaft being located within 600 feet of its south edge. The c tains principally malachite, azurite, chrysocolla, and a litt cite. It occurs mainly in the altered rhyolite and diorite.

impregnates and replaces, and locally it is accompanied by iron oxide and quartz. The main shaft is said to have encountered, at about the 50-foot level, a large body of rich ore of this class which continued downward for 18 or 20 feet and had a considerable lateral extent, especially in a northeasterly direction—a feature which, considered in connection with drill tests, indicates that the ore probably occurs in a nearly horizontal bedlike body. At about 40 feet from the shaft, near the south contact of the dike, the drill between depths of 60 and 78 feet passed through an 18-foot body of ore that seems to be similar to that encountered in the mine at about the same level. Between depths of 78 and 297 feet the rhyolite, as shown by the drill core, contains very finely disseminated pyrite but no other indications of ore, and from 297 to 347 feet the drill encountered only barren diorite. The run of mine ore is said to average about 4 per cent in copper and a few ounces to the ton in silver, with a small quantity of gold.

PLACER DEPOSITS.

Placer gold occurs in the Tyndall district, and some was produced in early days 2¼ miles southwest of Salero and 1 mile south of Mount Allen, at the southwest base of the Grosvenor Hills, on each side of the township line, in the SW. ¼ sec. 35 and adjoining ground, in the open basin-headed canyon which is tributary to Ash Canyon.

WRIGHTSON DISTRICT.

GENERAL FEATURES.

The Wrightson district adjoins the Tyndall district on the east, lying on the opposite or east slope of the southern part of the Santa Rita Mountains, as shown on Plate I (in pocket). It extends from the latitude of Old Baldy Peak on the north and Adobe Canyon on the northeast to Patagonia, 12 miles distant, on the south, and from the crest of the range between the Arizona-Pittsburg and Augusta mines to Sonoita Creek at the Pennsylvania ranch, 8 miles distant, on the east. Its southeast boundary follows Sonoita Creek to a point 2¼ miles below Patagonia, where it meets the west boundary, which follows the ridge between Temporal Gulch on the east and Squaw Gulch on the west. It is in Santa Cruz County. Patagonia is the post office and supply point for the district.

The topography is generally rough, of the eroded volcanic rock type, the surface being scored by many approximately parallel gulches or canyons, through which the drainage issues southeastward into Sonoita Creek and which render transportation trans-

versely to their courses difficult. The largest of these can Temporal Gulch, which heads on the south slope of Old B mile and a half from the peak, extends southward for 12 mil joins Sonoita Creek ¾ of a mile below Patagonia.

Across the west-central part of the district, in which most mines are located, the surface declines from an elevation of to 4,500 feet in the distance of 6 miles, or about 333 feet to th

The country rock, as shown on Plate II (in pocket), is n andesite, which occupies a north-south belt about 2½ miles w the west-central part of the district. In the northwest cor andesite gives way to a belt of the underlying rhyolite three- of a mile wide, which extends 4 miles southward into the distri which on the south, along the middle of the west boundary, ceeded by a similarly narrow belt of the quartz diorite and n nite of the adjoining Tyndall district. This in turn, along the ern part of the boundary, is similarly succeeded by the grani phyry of Squaw Gulch, which also underlies the andesite east. Almost the whole of the eastern part of the district ered by Quaternary gravels, through which, however, a sma of the Mesozoic shale protrudes on the north. The general re of the rock formations are indicated in section *C–D*, Plate I pocket).

The andesite belt shown on the map and represented in the locally, as at the Gringo and Anaconda mines, contains sma of an older or pre-rhyolite (?) andesite that could not be d tiated in this work. The belt also contains areas of the Meso trusives, for example, monzonite at the Mansfield and Augusta aplite at the Happy Jack, and granite at the Ivanhoe.

ORE DEPOSITS.

Compared with the west slope of the range and especially w Tyndall district, the Wrightson district is for the most par tively young in mining activities, though mineral deposits wer discovered here in the late seventies. The deposits contain cipally copper and lead. They occur in quartz fissure vei replacements in the igneous rocks, chiefly in the monzonite an andesite, largely in association with intrusives. A small gr the deposits, however, of which that opened by the Gringo n an example, carry gold only and occur in veins, principally older andesite, being similar to the gold bearing Tertiary occurring in the volcanic rocks of the West in general.

The district contains six or eight camps and 20 or more small and prospects, most of which are comprised in the subjoin